Scottish Government
Riaghaltas na h-Alba
gov.scot

Technology Enabled Care: Data Review and Evaluation Options Study

HEALTH AND SOCIAL CARE

social research

Technology Enabled Care Data Review and Evaluation Options Study

May 2018

Contents

List of Figures

List of Tables

Acronyms

AA:	Attend Anywhere
ALISS:	A Local Information System for Scotland
CHF:	Congestive Heart Failure
COPD:	Chronic Obstructive Pulmonary Disease
DGH:	District General Hospital
DP:	Digital Platforms
EBM:	Evidenced Based Medicine
EBM:	Evidenced-based Medicine
ERIC:	Expert Recommendations in Implementing Change
FtF:	Face to Face
HMHM:	Home and Mobile Health Monitoring
IS:	Implementation Science
LM:	Logic model
NHS:	National Health Service
RRRP:	Rapid, Relevant Research Process
SDR:	Social Discount Rate
SROI:	Social Return on Investment
SU:	Service users
TC:	Telecare
TEC:	Technology enabled care
VC:	Video Conferencing

1.0 Background and approach

This section describes the background to the Technology Enabled Care (TEC) Programme and to this study. It sets out the research questions, methodological approach taken and provides definitions of terms used in this report.

1.1 About the TEC programme

Launched in late 2014, the Scottish Government's TEC Programme is a circa £9 million a year Scotland-wide programme designed to significantly increase citizen choice and control in health, well-being and care services. Due to the start-up time required by many of the projects, the first phase of the programme will conclude in September 2018. Building on this, a second phase of work focusing on scaling up and adoption will commence from April 2018. The new Digital Health and Care Strategy for Scotland, published in April 2018, will build on achievements to date and set out future developments and priorities.

The TEC Programme was set up to respond to the need for service transformation in the context of rising demand for health and social care. By providing central funding to a dedicated programme, the aim is to drive technology enabled care deployment at the local level, alongside national infrastructure and support work and to place Scotland at the forefront of innovative approaches to technology enabled care

Scotland's leadership in this area has been recognised by the award of '4-star Reference Site' status by the European Commission's Innovation Partnership for Active & Healthy Ageing. This award, which is the highest standard under the system, was in recognition of its work on technology enabled care in an integrated care setting. Only 8 out of 74 sites were awarded 4-star status. Progress with TEC in Scotland has also been acknowledged in the recent Health and Sports Committee report (Health and Sports Committee, 2018)

The Programme has been structured over five interrelated workstreams:

Expanding Home and Mobile Health Monitoring (HMHM)

Expanding the use of video conferencing (VC)

Digital platforms

Further expanding and embedding the use of telecare

Improvement and support

Although most of the activities that take place under these workstreams are distinct, they are also intended to be mutually reinforcing. The aim is for the

whole to be ‘greater than the sum of its parts’, thereby furthering the adoption of technology-enabled care over and above the discrete activities. This recognition of the cross-cutting element of the programme led to the development of the fifth workstream, which is focused on enablers and barriers to implementation.

1.2 About this study

A key component of the TEC programme is a focus on service transformation and continuous improvement supported by measurement and evaluation. Over its life, many evaluative activities have taken place. These have primarily sought to demonstrate the effectiveness of technologies that sit within individual workstreams. They take the form of one-off evaluations, improvement reports and ongoing monitoring, and forecast reports to assess the impact of scaling up, particularly on cost-effectiveness.

The purpose of this study is to synthesise the findings of these evaluative activities and inform the priorities for future evaluations by systematically identifying gaps in evidence. Specifically, the aims are to:

- Develop a clear understanding of the expected outcomes of the TEC investment at programme and workstream levels for different groups of people over the short-, medium- and long-term and how these are expected to be achieved.
- Establish the nature, quality and relevance of existing evidence and identify key information gaps.
- Detail a range of options for Scottish Government, in association with the TEC Board to consider for a further phase of evaluation, explaining the extent to which each option would be robust and cost-effective in understanding the impacts of technology-enabled care and establishing longer term monitoring.

A further 11 additional sub-aims were also identified, which have informed the development of the research questions in the next section.

1.3 Research questions

The research will address the following five research questions:

- What is the range of the existing evidence and data on the TEC programme? What is the quality of that evidence and where are the key gaps for both range and quality?
- What do we know about the barriers and enablers to effective implementation of TEC?
- Once TEC is implemented, what do we know about how sustainable its use is over time?

- What is the state of knowledge on cost effectiveness? How is cost-effectiveness taken into consideration when scaling-up an approach – what is the standard of evidence used? How is cost effectiveness compared against clinical effectiveness and personal outcomes?

- What are the longer-term monitoring and evaluation requirements to support the on-going development and delivery of TEC? Are there standardised metrics that can be recommended for some grantees to report against that would support the development of the evidence base?

1.4 Study methodology

The study was carried out in seven stages between September 2017 and March 2018.

Stage 1: Develop logic models for workstreams and overall programme
Building on existing work in this area, a series of logic models were developed. This was conducted over the course of two workshops with workstream and programme staff. The logic models were subsequently refined by the researchers with reference to programme documents and secondary literature. Final versions were reviewed by workstream and programme staff. The logic models were developed to provide a means of systematically assessing the strength of the evidence base in each area of work against an agreed outcomes framework.

Stage 2: Initial classification of evidence
Evaluation reports were shared with Just Economics for inclusion in the review. Documents were categorised in a spreadsheet depending on whether they contained qualitative, quantitative or economic data (or a combination of these). Some contained non-evaluation reports (e.g. evaluation frameworks). These were reviewed for information but were not included in the data synthesis. Appendix 1 sets out the results of the classification.

Stage 3: Data review
Qualitative and quantitative data were reviewed separately. The quantitative reports were inputted into an Excel spreadsheet, which extracted data on geography, beneficiary, subject, sample size, population size, study type and outcomes. This process allowed us to efficiently summarise the quantitative evidence base, including key findings and gaps.

For the qualitative data, NVivo was used to analyse the findings. The analysis began by separating out the data by aims (e.g. outcomes, implementation and stakeholder type). For each sub-group, further categorisations, such as geography, age group, or beneficiary, were identified. These were then cross-tabulated with a set of variables (nodes) such as outcomes, satisfaction, barriers/enablers and sustainability. These nodes were developed through

coding of the raw data. Further sub-nodes were also identified where appropriate. Appendix 2 sets out the results of the data review by workstream.

Stage 4: Comparing data and evidence with logic model
In this stage, the evidence base was mapped onto the logic models developed in Stage 1. Matrices were constructed to indicate which elements of the logic model were supported by data, the type of data (qualitative/quantitative/mixed) and providing an assessment of its quality. The evidence matrices can be found in Appendix 3.

Stage 5: Economic data review
All TEC evaluations containing economic data were identified during Stage 2. This resulted in 11 evaluation studies across the four workstreams, which were systematically analysed with results entered in an Excel spreadsheet. For each study, data was extracted on findings, method, sensitivity analysis, discounting, benefit period, and input costs. This enabled us to make comparisons across studies and recommendations for standardising future economic evaluations.

Stage 6: Implementation research
One of the key findings of the data review is that, even for technologies where there is a strong evidence base, mainstreaming can be slow. As a result, it was decided to focus Stage 6 on implementation with an emphasis on barriers, enablers and strategies.

Stage 6 comprised three strands:

1) Identification of barriers and enablers to implementation in TEC evaluation studies (conducted as part of Stage 3).
2) Literature review on Implementation Science (IS), including its use in TEC to understand how IS had developed in TEC and what lessons could be learned.
3) Two workshops with staff involved in frontline delivery of technology-enabled care across Scotland and the TEC programme (see Appendix 4)

Stage 7: Measurement framework
The final research task was the development of a measurement framework and options for future evaluation. This was informed by:

1) A high-level literature review of measurement and evaluation approaches to technology-enabled care
2) The review of existing evaluations in Stages 2-3
3) Direct engagement with TEC staff at the logic model and implementation workshops in Stages 1 and 6

1.5 Definitions

For the purposes of the Scottish Government-funded programme and this study, Technology Enabled Care (TEC) is defined as “where outcomes for individuals in home or community settings are improved through the application of technology as an integral part of quality, cost-effective care and support”. There is an explicit emphasis on home and community settings and on quality. The focus is on individuals rather than, more narrowly, patients. This reflects the integrated context for health and social care in Scotland.

The definition encompasses a vast range of applications from the provision of online information to sophisticated monitoring devices and complex remote interventions. There is also a wide range of related terms including digital health, eHealth, mHealth, telehealth, telemedicine, assisted living, home automation and smart homes, and these terms are often used interchangeably. This creates some difficulty when comparing technologies as the same technologies can sometimes be described using different terms. Whilst the term TEC is usefully broad, this also means it covers a wide range of applications that differ from each other in terms of their intended process and outcomes.

A final note on language relates to the beneficiaries of the TEC programme. Under some workstreams, such as telecare, that are in the social care sector, beneficiaries are known as service users. Under health-oriented strands, such as HMHM, they are called patients. For services like the health and care portal, citizens may be the most appropriate term. To overcome this, we have used the term ‘clients’ for all direct beneficiaries or users unless otherwise specified.

1.6 Report structure

The remainder of the report is structured as follows:

- Section 2 presents the findings from the logic model development and data synthesis. We describe the narrative, present the logic models and set out the evidence base for the programme, and for each workstream.
- Section 3 present the findings of the economic evaluation review
- Section 4 discusses the findings of the implementation research
- Section 5 presents the measurement framework, evaluation options and concludes the report.

2.0 Logic model development and data review findings

This section describes the outputs from stages 1-4. We present the logic models in diagrammatic and narrative form, discuss the evidence base, and make recommendations for future evaluation priorities in each area. A total of 95 documents were submitted to Just Economics for review. Of these 54 contained evaluation data, and these were synthesised (see Appendix 1 for further details of the data classification and review).

The TEC programme has a strong commitment to evaluation and this is reflected in the number of evaluation studies undertaken. As a group, these studies point to a solid evidence base, especially for two of the workstreams; telecare and HMHM. In other areas, the evidence base is still 'emergent'. This is to be expected, however, given that workstreams are at various stages of implementation and many of the outcomes are expected to take place beyond the life of the programme. In addition, whilst there are still some gaps for evidence in Scotland, the programme is building on a large international evidence base in areas such as telecare and HMHM, and these areas were chosen based on the strength of that evidence base, making evaluations of some outcomes by the TEC programme unnecessary.[1]

The evidence base also partly reflects the difficulties associated with the measurement and evaluation of technology in health and social care. Technology-based interventions create a unique set of evaluation challenges, which can conflict with the requirements of experimental research designs. Experimental research designs, in the context of rapidly-evolving technological change, may also fail to provide data in a timely fashion (Glasgow et al. 2013). For this reason, our emphasis in the data review is on pragmatic, relevant, and well-designed evaluation studies (see the measurement framework in Section 5 for further discussion of these criteria).

2.1 TEC programme logic model and evidence base

The TEC programme is designed to function as 'more than the sum of its parts'. At the heart of its strategic vision is catalysing the transformation of health and care services such that technology becomes integrated as 'business as usual', thereby allowing more delivery of services at home and in community settings. The logic model set out below aims to capture how the various programme elements seek to build the local and national conditions to deliver on this vision.

[1] . A comprehensive summary of TEC evidence has been compiled by the NHS https://www.england.nhs.uk/tecs/strategic-planning/

2.1.1 Programme logic model

The logic model for the programme is intentionally forward-looking (see Figure 1). It reflects what the programme is aiming to do in the coming years and the programme legacy, if those objectives are achieved. It should also not be seen as static, but rather as an evolving set of activities that respond to new evidence as it emerges and changes in context (e.g. technological change).

The programme operates at two levels. At a national level, the programme seeks to create the conditions to support adoption of new technologies and scaling up. This includes building the infrastructure, tools and approaches that are required on the ground, and tackling existing technological, social, organisational, and cultural barriers. At a local level, it seeks to grow TEC activities and initiatives through dedicated funding to organisations implementing or trialling TEC initiatives.

There have already been considerable successes for the programme, with an additional 66,000 clients benefiting from technology-enabled care (to February 2018), sharing of learning across settings, and progress on infrastructural issues, such as the analogue to digital switchover.[2]

Going forward, the TEC Programme Board has identified the following four areas in its Strategic Priorities for technology enabled care 2018-21 in support of the new Digital Health and Care Strategy for Scotland:

Transforming local systems – supporting exemplars that are seeking to transform local health and social care systems using digital technology to shift local systems upstream to prevention, self-management and greater independent living.

Developing approaches once for Scotland – developing approaches that have been shown to be effective, supporting scaling up across Scotland and addressing barriers that require national level action.

Preparing for the future – identifying and testing new approaches that offer the potential to achieve change at scale.

Building capabilities and supporting improvement – championing, supporting, gathering and promoting the evidence of what works, to develop the culture and skills that recognise and use digital TEC including through developing business cases, supporting strategic planning and delivery.

These strategic priorities aim to increase the number of people using fit-for-purpose technologies and for those technologies to either a) free up capacity within the system without any risk to care quality or b) improve health and

[2] See TEC Strategic Priorities 2018-21 Final, Board Paper

social care outcomes (or, indeed, both simultaneously). Ultimately, the goal is to enable citizens to enjoy longer, happier and healthier lives in their own homes, thereby reducing demand on current services and freeing up capacity.

Achieving these strategic priorities occurs via several pathways. These include the use of Attend Anywhere for remote clinical and care consultations and decision support, improved condition control and self-management via remote monitoring and digital platforms, more technology-enabled care options being used in care homes and better access to specialist services, especially for those with long term conditions and those experiencing health inequalities.

The benefits of increased roll-out of technology-enabled care extend beyond users of these services. The health and social care workforce, in the short-term, is expected to feel more supported in their roles and less burdened. Longer-term, we would expect to see improvements in well-being, either through removal of routine tasks, reductions in workloads, or reduced stress from working in a more efficient system.

It is also expected that the programme will positively impact on the well-being of unpaid carers. Technology-enabled care is expected to reduce some routine tasks and the need for certain face-to-face appointments, thereby reducing the workload of some unpaid carers. Further, it is expected that some technology-enabled care options, such as telecare and HMHM, will provide reassurance to carers. Wider social benefits have been identified for interventions at scale. These include improving the viability of vulnerable services and communities, reducing CO2 emissions and economic benefits from the improved productivity of a healthier workforce.

Another objective of the TEC programme objectives is to reduce health inequalities and there are various means by which the technologies can play a role within this. However, for all the technologies, excepting telecare, digital exclusion is a potential barrier to achieving this. That is, whilst technologies like video conferencing or HMHM can bring services to people who currently have more limited access, they also require minimum skills and infrastructure to be fully exploited. Given that those who experience health inequalities are also more likely to be digitally excluded (e.g. older people, disabled people, people in remote locations and those on low incomes), there is a risk that technology-enabled care will exacerbate inequalities. Further, it is important to distinguish between inequality of access and inequality of outcome. Although clearly correlated, better access to services is not the sole determinant of greater equality of outcome and both should be priorities for measurement.

A signal that technologies are being exploited to their full potential is that technology-enabled care options become the default within decision-making in health and care teams. This is a key objective for the programme and underscores the importance of advocacy work to increase uptake. This is vital

as some of the main systemic benefits of technology-enabled care will only be realised at scale. For instance, a motivation for incorporating technology into health and social care is to reduce the demand for mainstream services by enabling people to self-care, be cared for remotely, or to improve their lifestyles and behaviours such that they require fewer health or care interventions. From the perspective of health and social care services, it is possible to place a monetary value on outcomes, such as the reduction in hospital admissions, reduction in care home admissions and the logic model includes a longer-term outcome around reducing the per capita costs of services for those with long-term care needs. However, all the technologies that form part of the programme are interconnected, and exhibit strong network effects, individually and as a group, meaning that maximum value is only achieved at scale.

There are three ways in which this happens. First, there are the network benefits to users of the technologies. A network effect is an economic concept, which describes the positive effect that each additional user or good or service has on the value of that good or service to others. The internet is a good example where a greater number of users increases the value to other users. Even with a small number of users the internet can still be valuable, but its value increases the more users come online. In an analogous way, whilst technology-enabled care users can personally benefit, they benefit more when (for example) all health and care staff can be contacted via a digital portal or VC.

Second, economic benefits and savings to the health and social care system will not be fully realised until a critical mass of people are using the technologies. For example, if an intervention like telecare is shown to prevent hospitalisation, the marginal benefit of each additional bed day saved will be quite small as the hospital and individual wards will still need to operate at full capacity. As the number of users increases and the pressure on hospitals reduces, the marginal value of the bed days saved increases. However, even then, given the demand for health and social care services, the result is likely to be a redeployment of care service to an area of unmet need rather than the realisation of a ‘cashable’ saving.

Third, integration of technologies with each other has the potential to increase value to users and the government. For example, in time, a user may be able to upload their home health monitoring data to the digital portal where it can be accessed by their GP, who may schedule a video conference call to discuss results and where lifestyle information relevant to those results will be available. We would, therefore, expect the social value of the technologies to increase over time with greater integration. Identifying the points at which a critical mass is reached is challenging and outside of the scope of this study. However, some forecasted economic studies reviewed as part of this evaluation have attempted to do this and are discussed in section 3. These

have focused on technologies, such as telecare, that are further into the implementation life-cycle.

The logic model diagram for the programme is set out below (see Figure 1). Given the forward-looking nature of this logic model, we have not included an evidence matrix for the programme. Progress on achieving the overall programme objectives is covered in the discussion around implementation in Section 4. A set of programme-specific recommendations will be provided in Section 5.

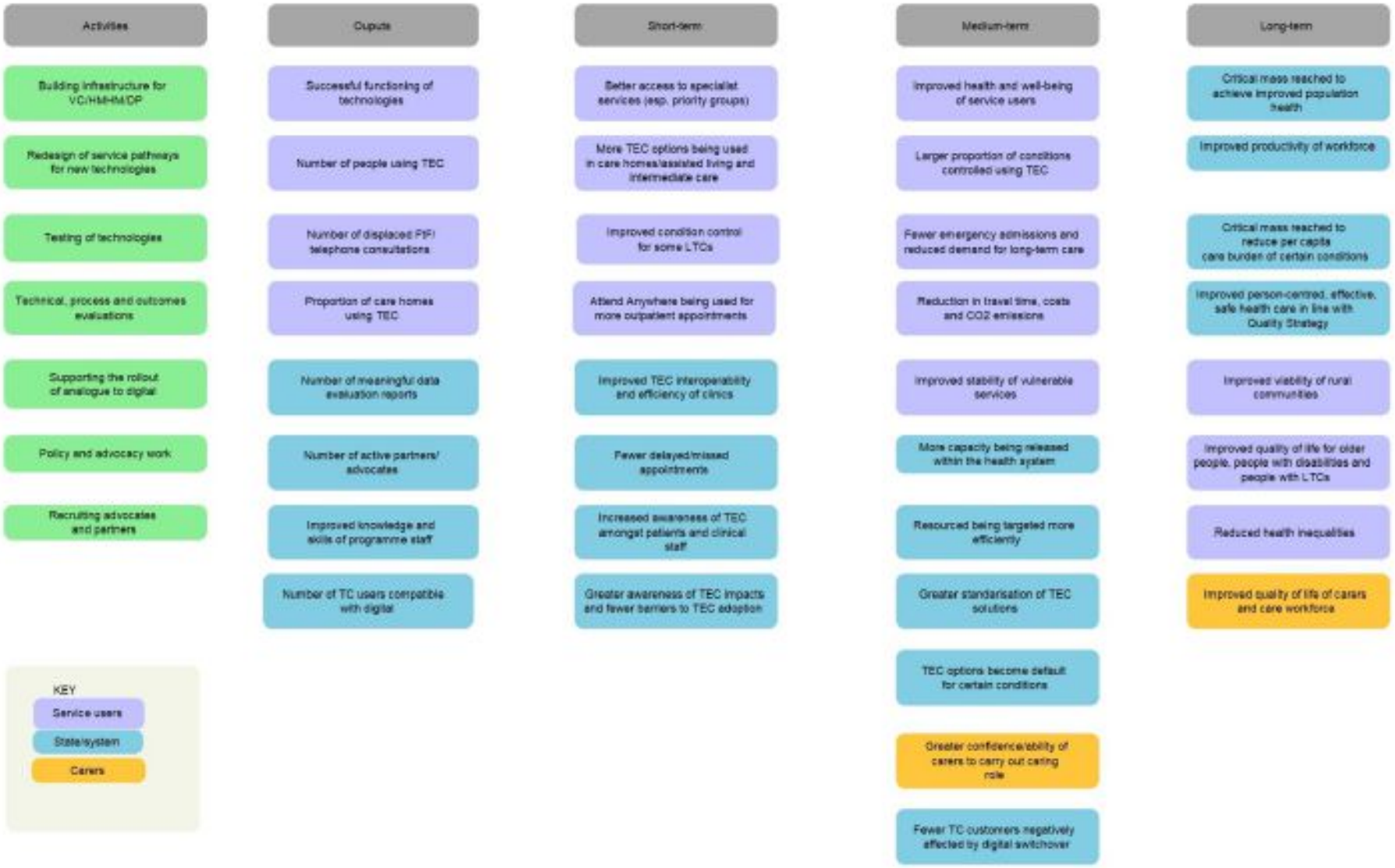

Figure 1: Overarching logic model

2.3 Telecare

Telecare refers to continuous, automatic and remote monitoring of users by means of sensors to enable them to continue living in their own home by minimising risks such as falls, gas leaks or flooding. A key element of the programme in Scotland is an effective triage system, which ensures that emergencies are prioritised. Telecare is one of the most widely used technology-enabled care devices in Scotland. According to the most recent data, there are nearly 130,000 local authority-provided telecare systems in operation.[3] It is estimated that a further 50,000 are in receipt of Telecare from housing associations and social care providers. Among those aged 75 and older, 20% are using a telecare device or service.

2.3.1 Telecare logic model

The logic model (see Figure 2) set outs several ways in which the implementation of telecare can both improve outcomes for clients, families, carers and health and social care professionals, and be cost-saving.

Firstly, insofar as the telecare service operates an effective triage system to ensure that resources are well-targeted, care and support services should operate in a more timely and cost-effective manner. To this end, the workstream has sought to integrate the telecare response into the wider responder network. Better targeting of resources ensures peace of mind that emergencies will be dealt with appropriately and that telecare users are safe in their own home with fewer falls, fires and the reduced risk of complications that arise from them. This, in turn, is expected to enable people to remain in their homes for longer, leading to a reduction in hospital/care home admissions, fewer incidents of delayed discharge and reduced need for costly overnight/sleepover/wakened care. As discussed above, avoiding hospital may be very beneficial to an individual telecare user, whereas the value to society is likely to be low initially but increasing over time as usage widens and telecare becomes integrated with other technologies.

The imperative of preparing for the analogue to digital transition was identified early in the programme and this has been a major focus of the telecare workstream. The aim has been to ensure that telecare clients receive a seamless service throughout the switchover period and that opportunities for integration of telehealth with telecare data and technology is facilitated. This aspect of the work has been monitored in terms of the rate at which people transition but not subject to an evaluation at this stage, so is not included in this synthesis.

[3] This figure relates to local authorities only and excludes those accessing telecare via a housing association or any other private arrangements

A final benefit set out in the telecare logic model, which is shared with the other workstreams, is to increase the choice available to clients and to deliver more person-centred and responsive care and support services. All these outcomes should combine to improve the quality of life and well-being of services users, especially those with conditions, such as dementia, frailty and/or those experiencing health inequalities.

A key measure of the success of the telecare workstream is the extent to which it becomes a mainstream option within community provision. This is not just about the number of users but also about the attitude of health and care teams. It is expected that, as telecare moves to the mainstream, telecare packages become the first point of referral at discharge, or for those in the community in need of care and support. The production of robust evidence and data is central to this. The programme seeks to understand the data landscape better and progress the opportunities that telecare services can bring to clients and their carers. As a result, there has been an emphasis on demonstrating the economic and quantitative benefits of telecare to overcome barriers regarding trust in its use. The workstream has also sought to exploit the opportunities provided by Big Data, for example using demographic data to identify new potential users.

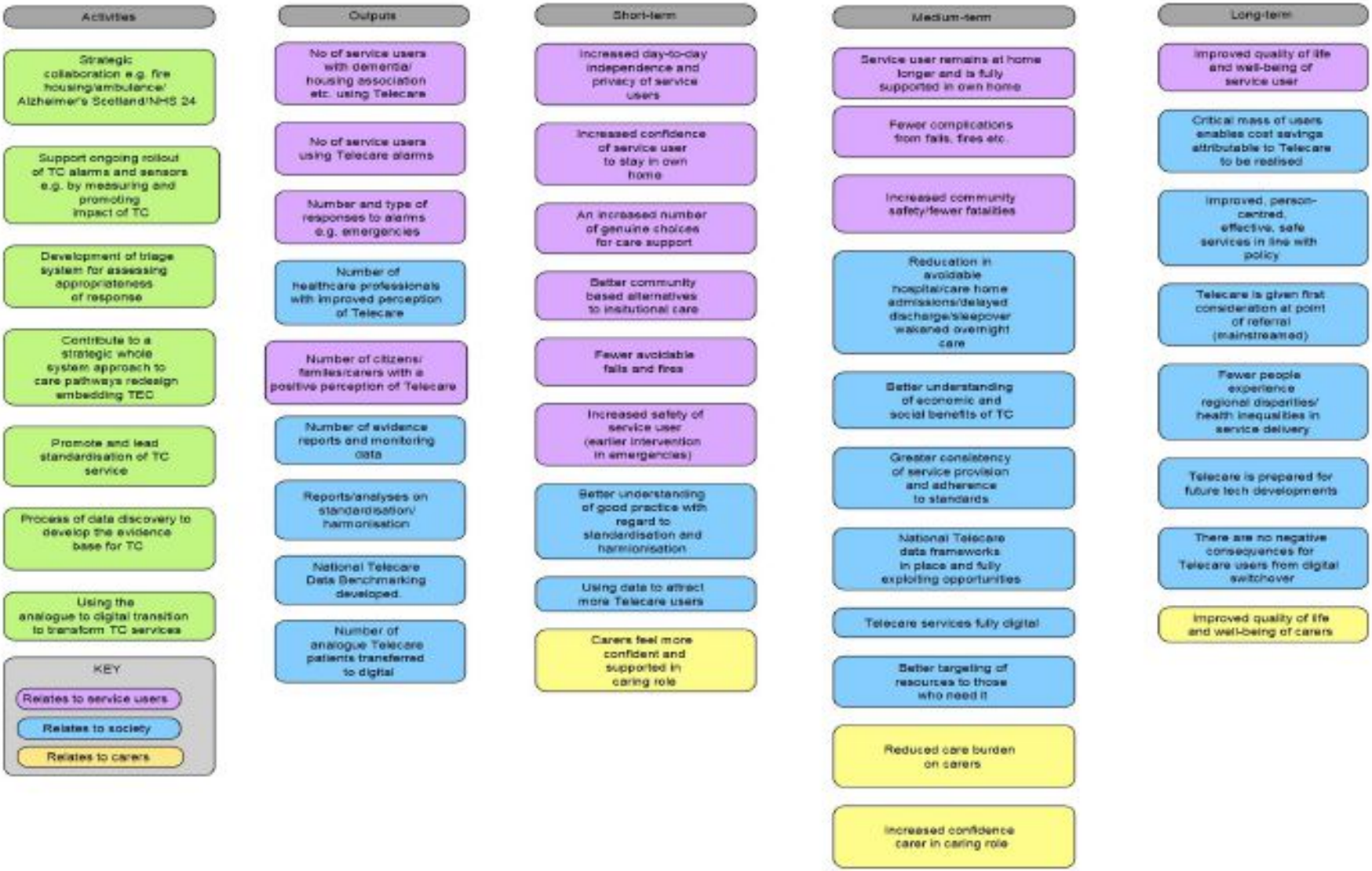

Figure 2: Telecare logic model

2.3.2 Evidence base for telecare

There was a relatively strong evidence base for telecare, with a total of eight evaluation studies with quantitative data and three with qualitative data (see Appendix 2 for a summary of evidence sources for each workstream). This reflects the emphasis on producing evidence to support scaling up. A comparison of the data and outcomes identified in the telecare logic model is available in Appendix 3.[4]

Across all the studies, a range of outcomes were evidenced, including:

- enhanced dignity, independence and quality of life for clients
- increased confidence of vulnerable clients to be more active
- increased health and well-being of carers
- reduced unplanned hospital admissions and prevention or delay of admission to care homes.

There is also evidence that telecare has specific benefits for people with dementia, providing that it is introduced early enough in the development of the condition.

Both the qualitative and quantitative data highlighted wide variation in the provision of telecare across Scotland. There are a range of providers, often using different equipment. This presents challenges in moving to a universal telecare approach. It also makes it more difficult to generalise the findings of research which focus on a specific telecare solution, provider, equipment and so on.

A wide discrepancy in charges for the telecare services was also reported in both the quantitative and qualitative data. The qualitative studies repeatedly identified charging and the way this is implemented (e.g. framing of the invoice letter; monthly vs. quarterly invoicing) as a potential factor influencing dropout rates. The recent report from Deloittes (2016) recommends that the impact of charging requires further investigation. Although a policy, rather than programme issue, it is a barrier that still needs addressing. Future studies could also seek to identify the causes of user drop out (other than going into a care home or mortality). Of further benefit would be research on ways to harmonise telecare provision to reduce service variation. This could look at examples of where local authorities have merged operations, including challenges they encountered in standardising their approaches and technologies.

[4] As mentioned earlier, the programme was developed based on an existing evidence base. The summary in Appendix 1 only includes findings from new evaluations carried out as part of the TEC programme. Some 'gaps' may, therefore, exist due to the evidence base already being established elsewhere

2.4 Video Conferencing

The initial focus of the video conferencing workstream was on expanding traditional video conferencing beyond the NHS, across public services and into community settings. This had some initial success but was delayed for technical reasons. In 2017, the integration of video conferencing into health and social care has been driven primarily through the Attend Anywhere system. Alongside this, work continued supporting those areas with a more traditional technical set up. Attend Anywhere is a bespoke platform that allows health and care staff to offer video calls as part of their day-to-day operations. There has been considerable success with rollout. The system is functional in 13 out of 14 Health Boards and being used by 8 third sector organisations and in care homes

2.4.1 Video Conferencing Logic model

The logic model for video conferencing (see Figure 3) is derived from the development of general remote consultations/access, rather than Attend Anywhere specifically. Implementation is still in the early stages, and programme and delivery staff are working to improve the reliability and functionality of the infrastructure upon which it depends to support a greater number of connections between organisations and systems. There are two main uses of video conferencing for health and social care: firstly, for consultations directly with citizens and, secondly, for providing specialist input/support to health and care staff.

The primary beneficiaries of this technology are health and social care clients and their carers. Video conferencing could lead to shorter waiting times for appointments and better access to specialist services, thereby improving client outcomes and well-being. Time may be freed up for carers by reducing the need for them to bring clients to appointments. There are also circumstances where video conferencing may be preferable to a face-to-face consultation. This is the case for so-called ‘hard to reach’ clients. These include prisoners and people with anxiety disorders, frailty or disability, which impedes them from leaving the house, or people living in remote or rural locations who may be discouraged from using services due to the cost and inconvenience of travel. These groups may be experiencing service inequalities, which video conferencing has the potential to improve. For remote communities, video conferencing could also improve the viability of services that are at risk of closure by enabling them to access specialist input and extend their service offer. This, in turn, could impact the sustainability of those communities in the longer-term.

As with other areas, a substantial part of the workstream activities relate to the promotion of the technology through advocacy and evaluation, alongside tackling barriers to its adoption. The aim is to integrate video conferencing into

health and social care as well as wider public services, where VC meetings could improve communication and collaboration between professionals and reduce the need for travel. Longer-term, these technologies could impact on the workload and work/life balance of health and care professionals, thereby improving recruitment, retention and well-being.

The programme has recognised the benefits of aligning approaches within HMHM to support video conferencing consultations. As discussed, earlier video conferencing along with along with other technologies exhibits strong network effects. This has implications for cost savings and for CO2 emissions, which likewise suffer from network effects and only become material at scale.

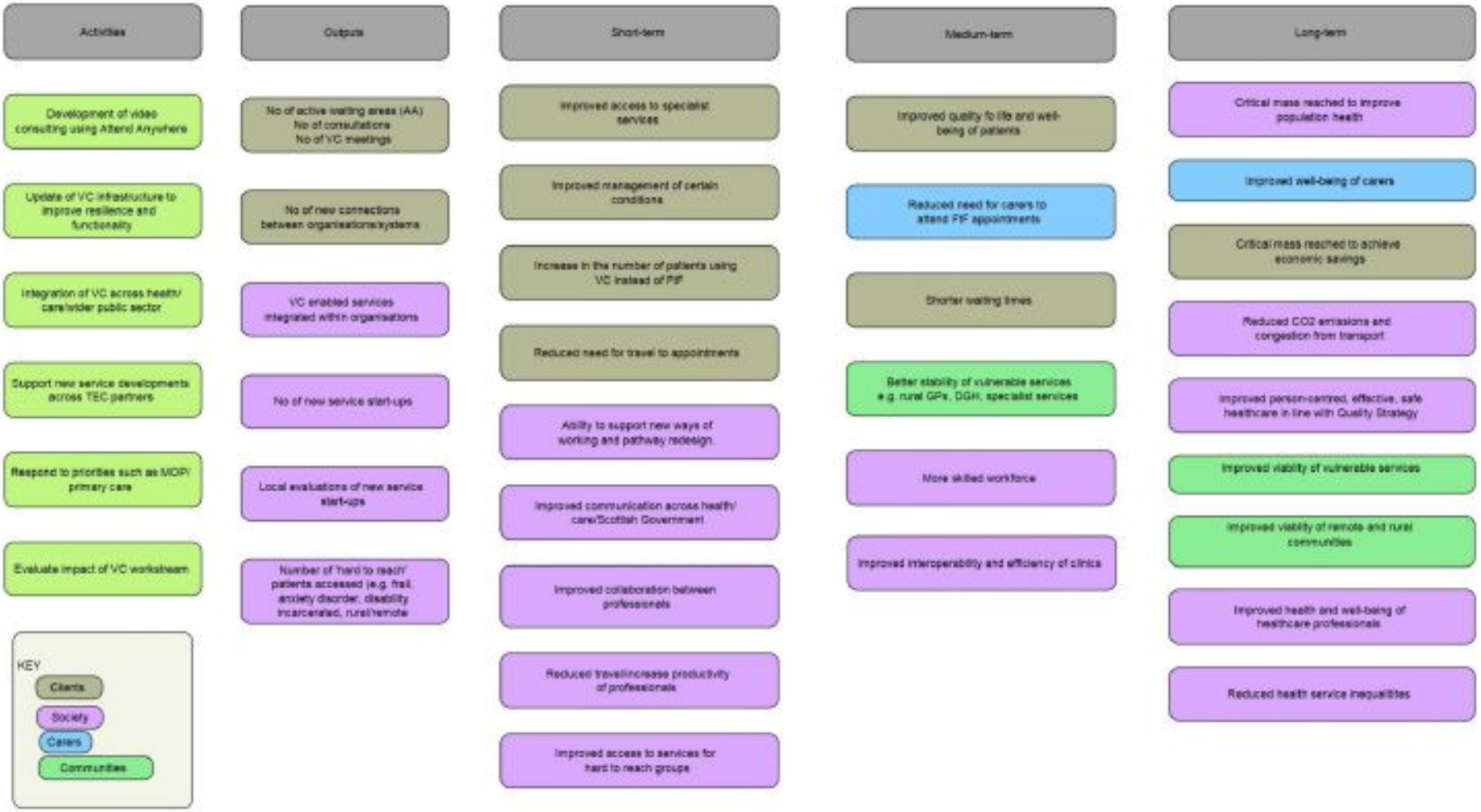

Figure 3: Video conferencing logic model

2.4.2 Evidence base for video conferencing

There were five reports containing quantitative information and four with qualitative information on VC. These reports reflect the historical focus of the workstream and are broader therefore than the Attend Anywhere system, which is still in the early stages of implementation.

Several of the quantitative studies reported solely on usage. Two of the reports were robust outcomes evaluations examining the use of video conferencing to provide specialist input to remote areas. Outcomes demonstrated included:

- Better pharmaceutical management
- Improved access to specialist services
- Reduced hospital admissions and length of stay
- Cost, time and travel savings for staff and clients
- Staff having greater confidence in the care they are providing
- Family and clients having greater confidence in the care they are receiving, although this is based on very small samples and/or staff reports

The technology – in these studies not the Attend Anywhere system – was described as highly reliable and both settings had been provided with the necessary equipment, infrastructure and training to effectively use video conferencing. For some staff, regular video conferences with the remote specialist increased workload (e.g. preparing files for the meetings) but this did not lead to resistance as staff could see the substantial benefits that were derived from these meetings.

A third evaluation study looked at the use of video conferencing technology by Edinburgh GP practices. In this setting, the response from staff to video conferencing was more mixed. While generally regarded as preferable to telephone consultations, there were concerns about the adequacy of the technology, impact on workload and the purpose for which video consultations could be used (e.g. sufficiency of diagnostic information compared to face-to-face consultations).

Evaluations to date have primarily focused on using video conferencing to gain specialist input and not on the routine use of video conferencing for consultations with clients or for wider relevance on remote access in public services. However, these are important potential uses of video conferencing and should be considered in the future. Although staff and users are asked to complete a survey after an Attend Anywhere consultation, these have not been reviewed as part of this research. The evidence base in this area could also be enhanced by collating and analysing the Attend Anywhere surveys

and by undertaking more in-depth studies of how family members and clients experience video conferencing including outcomes of interventions etc. Finally, the impact on services/professionals is a further area that merits additional research.

The evidence base, mapped against the video conferencing logic model, is set out in Appendix 3. This mapping, as noted above, reflects video conferencing use more generally rather than use of the Attend Anywhere system specifically.

2.5 Digital Platforms (DP)

This workstream is concerned with supporting the development of an integrated digital platform that enables people to access their health and care records, engage with the health service and manage their own healthcare. This is an ambitious goal that is expected to eventually lead to an independent programme of work. The role of the TEC programme has been to support proof of concept on development work for the National Health and Social Care portal, including commissioning a business case and testing components of the portal. The TEC Programme also supported two key citizen-facing programmes, Living it UP and ALISS (A Local Information System for Scotland). Living it UP was a significant aspect of the Digital Platform work in the first three years, along with a focus on developing the core platform.

One of the key objectives of the National Health and Social Care platform, once operational, is to facilitate integration with other current and future tools and technologies to create seamless interoperability between technologies. This is a key area of development for the new Digital Health and Care Strategy and it is expected that such a digital platform will provide:

- A portal where people can access their own records, manage their own healthcare and seek advice/support about their condition
- A safe and secure means for people to access reputable online services
- An access point for people to book and attend video conferencing consultations (using Attend Anywhere),
- An opportunity for people using HMHM to upload their monitoring or telecare data for oversight by a clinician, carer or support service

The development of such a portal is in the early stages and to date only parts of the system have been developed and/or tested.

The logic model in Figure 4 relates only to the health and social care portal (i.e. the first bullet above). Participants at the logic model workshop for this workstream decided to focus on this aspect as the benefits of the remaining elements are already covered to some extent by the other workstream logic models and the additive benefits of integration into the digital platform are difficult to ascertain at this stage of development. However, it would be

beneficial to undertake some further work exploring the likely benefits of the fully functional platform.

For the health and social care portal, the system would allow people to view their records, scheduled appointments, prescriptions and test results as well as be given advice and support relating to their risk factors. There are several potential benefits of such a system. First, it supports objectives around achieving person-centred care and greater co-production of healthcare. This should improve people's knowledge and understanding of their own health conditions and treatment. In turn, this would be expected to lead to greater adherence to treatment programmes and motivate people to adopt positive lifestyle/behaviour changes that impact on health and well-being. This should also improve satisfaction with the system. Client oversight of their own healthcare should reduce the number of clinical and medication errors, which should improve user safety. This should also reduce the litigation liabilities of the NHS (which are currently substantial). Better management of health and health conditions through the portal should also mean fewer working days lost and higher productivity.

The system should create time savings for both the client and the professional by reducing the time taken up with conveying information, results and so on. This should lead to greater efficiency within the health service. The requirement to reach a critical mass of users has already been discussed. Whilst benefits to individual users may exist at low uptake, as the number of users increases so does the value to those users and wider society.

Finally, where clients access their own information, or a service, through the portal, this may reduce the need for carers to carry out these activities, thereby reducing the care burden and potentially positively impacting on the well-being of carers.

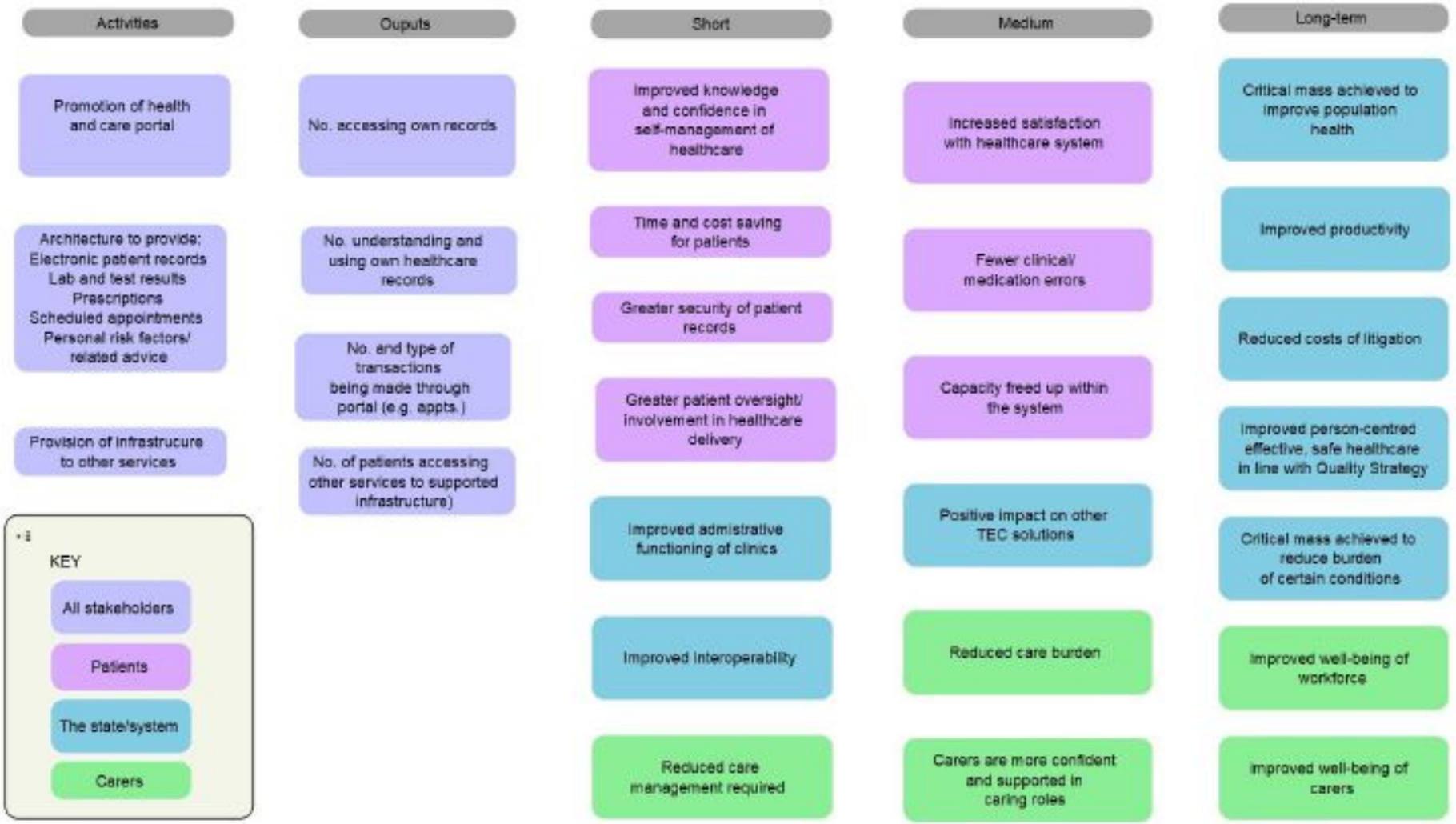

Figure 4: Health and social care portal logic model

2.5.1 Evidence base for Digital Platforms

Given that this workstream is largely concerned with supporting a technology that is yet to be developed, it understandably does not have an existing evidence base. For this reason, we have also not provided the usual matrix mapping the evidence base against the logic model.

However, evaluations of several other digital portals, carried out as part of the TEC programme, provide some insight into the benefits that a National Health and Social Care platform might provide. The evaluation of the Living It Up platform, which has now been integrated with NHS Inform, provides the most comprehensive assessment of the outcomes that can potentially be derived from the use of digital platforms for those managing chronic conditions and for their carers. The study used a controlled prospective design to undertake an SROI evaluation. Benefits identified in the study included:

- Greater sense of control and self-management
- Reduced social isolation due to making local connections (e.g. through volunteering, finding local activities or resources)
- Finding out information about their condition (which they had not received from health professionals) and how to manage it

The data review for this workstream also included two process evaluations of ALISS and a journal article examining readiness for digital health platforms at macro, micro and meso-levels (Lennon et al. 2017). The process evaluations set out the steps taken to develop ALISS but do not contain outcomes information. The journal article draws on interviews with key implementers (n=125) and a small number of users (n=7) to highlight several issues related to rolling out digital platforms, including the potential sense of disempowerment felt by health staff, inequalities of access because of different levels of digital/IT skills, and fears around data safety, especially where platforms are run by non-NHS bodies.

Unlike some of the more developed workstreams, evaluations to date have mostly focused on technical or process issues. In the future, Digital Platforms would benefit from a greater focus on outcomes measurement of systems such as ALISS.

2.6 Home and Mobile Health Monitoring (HMHM)

HMHM is the use of digital remote monitoring technology to enable patients outside of hospital to receive, record and relay clinically relevant information about their health and wellbeing. In March 2015, prior to the start of the TEC programme, there were 485 users of HMHM. This had increased to 10,780 by December 2017, with 12 Health and Social Care Partnerships now undertaking work in this area.

2.6.1 HMHM Logic model

Figure 5 shows that most of the activities under this workstream relate to supporting the take-up of HMHM through service redesign, awareness-raising and the production of evidence reports. The benefits of self-management are not just related to condition control and adherence to treatment but should improve the satisfaction and well-being of people living with long-term conditions. This outcome is expected to improve the likelihood that people can live independently for longer and have a higher quality of life whilst doing so and reduce reliance on traditional health services including admission to hospital. Although it is not clear that this will reduce the burden on carers, it is expected that carers will feel more supported in their caring role and that this will enhance their quality of life. It may also reduce the need for carers to attend some appointments, thereby providing respite.

From the perspective of the health and care system, network effects apply as with the other technologies. This means that, although capacity can be freed up within the system, the marginal savings are likely to be low in the early stages of implementation. Over time, however, these could translate into a more cost-effective health system.

Although the benefits to people with long-term conditions is a major driver of HMHM roll out, HMHM can also be used with other clients and services. For example, there are positive examples of its use to support remote decision-making within midwifery services, post-surgical services, and rehabilitation services. These examples suggest that HMHM could potentially be relevant to any user of the health service.

One of the TEC programme objectives is to reduce health inequalities and HMHM can play a role within this. However, as with other areas such as video conferencing, existing digital exclusion may act as a barrier to achieving this.

For clinicians, the expectation is that HMHM will help to support decision-making, thereby improving job satisfaction and a sense of efficacy in their roles. There is also potential for HMHM to reduce the amount of routine activities within clinical roles once economies of scale have been achieved.

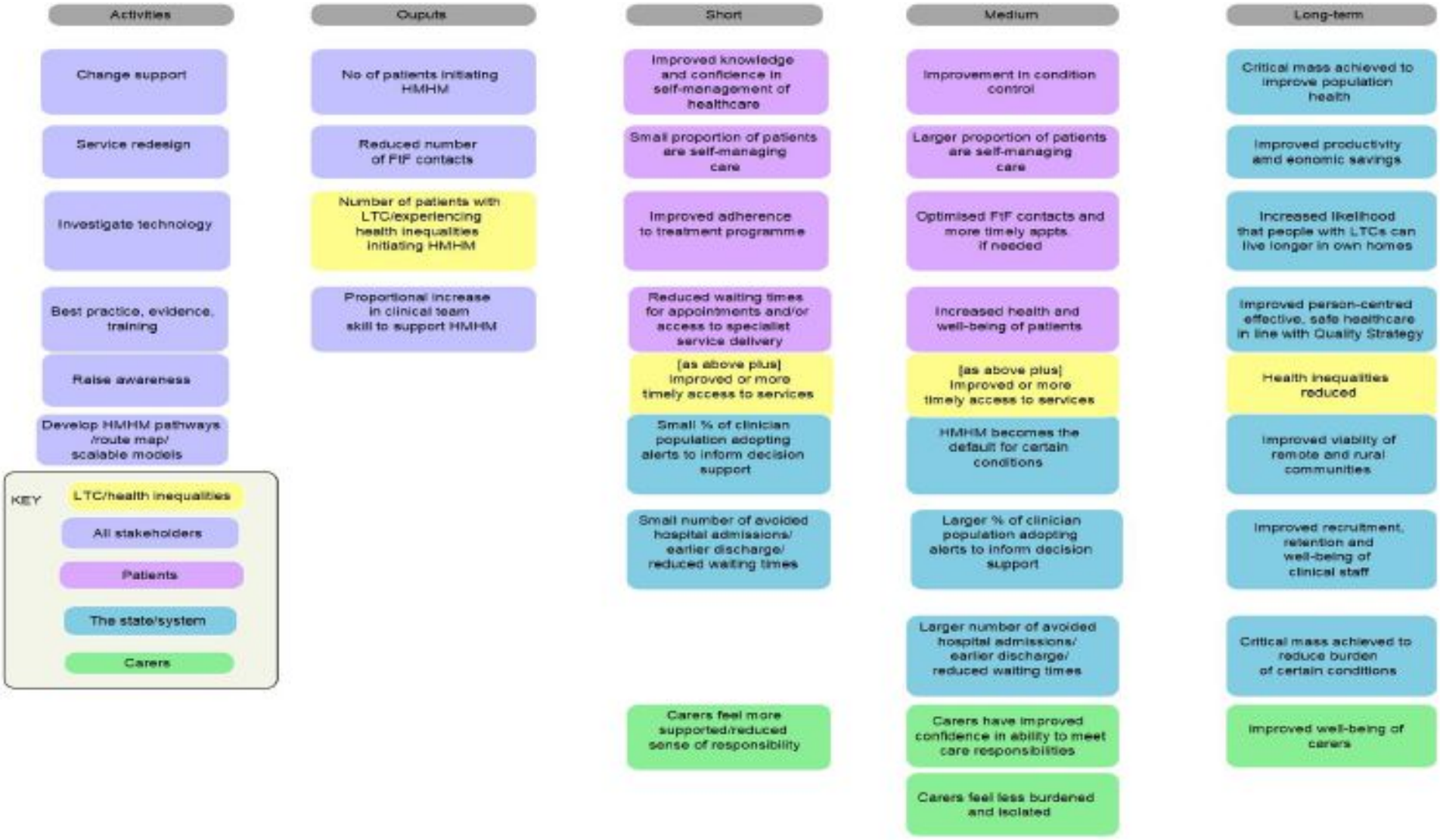

Figure 5: HMHM logic model

2.6.2 Evidence base for HMHM

This workstream had the largest number of reports of any workstream, reflecting in part the extent to which the technologies underpinning HMHM are becoming embedded in clinical practice (compared to video conferencing and digital platforms) and the specific focus of this workstream on developing an evidence base.

The reports provide a solid basis for identifying some of the key outcomes, as well as challenges around the use of HMHM (see Section 4 on implementation). The main outcome for patients centres around a feeling of reassurance from the increased connectedness that HMHM offers. Having a clinician in the 'loop' was vital to achieving this outcome. There was both quantitative and qualitative evidence for improved health through a combination of increased motivation to self-manage their condition and more responsive care (e.g. titration of medicines in response to readings), although the findings are less impressive for COPD than some other long-term conditions. These have been confirmed by a recent NHS England summary of HMHM impacts (Wolters, forthcoming). As well as better self-management and condition control, the report found some evidence for reduced hospital admissions, optimised face-to-face contact and access to services. This was also the finding from a recent study on the scale up of blood pressure monitoring (McKinstry et al. forthcoming). Although initial take-up of the service was from affluent practices, this changed over time, suggesting it could play a role in reducing health service inequality. The study also found a reduction in the number of face-to-face appointments over the course of the study.

Challenges centred mainly around the use of the technology (e.g. connectivity, having necessary tech skills) and overcoming the initial trepidation of staff and patients around its use (e.g. staff fears around impact on workload; patient fears around the ability to use the device/technology). There was some evidence of reduced health visits and hospital admissions. In the short-term, however, for some patients the introduction of HMHM increased demand for services by uncovering new health and/or care needs.

The literature also points to some implementation challenges for HMHM, though these require further exploration. The first of these relates to the possible negative effects of patients being able to readily access information about their condition in the form of graphs and trends that they do not fully understand. However, this can be addressed with the right support for users. A second negative outcome relates to the increased demand on staff in the early implementation stages because of switching to a new system and embedding this in usual work practices. This is a common problem with technology deployment and will be discussed later as part of the discussion on implementation.

This evidence for this workstream is the most well-developed but it could benefit in the future from further research on implementation as HMHM is applied to additional conditions, and for multiple conditions. A further challenge is evidencing prevention. This is an important part of the evidence base for HMHM, particularly for people with long-term conditions. The contribution HMHM directly makes to self-management, especially for different populations and interventions, and the type of service models that should be adopted to optimise this at scale are further areas for research.

Finally, there is some evidence to suggest that carers are key to ensuring effective use of HMHM by the patient and that they may also experience benefits in the form of reduced anxiety and an increased sense of reassurance. Again, this merits further research. The evidence base, mapped against the HMHM logic model, is set out in Appendix 3.

3.0 Review of economic evaluation data

This section presents the output from the review of the evaluations containing an economic component. We begin with an overview of the data received before discussing the findings and recommendations. As much of the material used in the reports discussed here has already been covered under the workstream discussions, this section focuses more on the methodological issues arising from this analysis. Further information on the data review methodology is available in Appendix 1.

3.1 Overview

Ten reports were reviewed that contained economic data (see Appendix 1). The approaches to economic evaluation varied across the reports. The two areas which have seen the greatest levels of funding and are furthest along with implementation - HMHM and telecare – have the strongest evidence base around economic return (e.g. the United4Health studies in HMHM and the evaluations by York Economics of telecare use for dementia patients in Renfrewshire and the longitudinal study on the Telecare Development Programme 2006 - 2011). There was only one study – the Living it Up evaluation in the digital platforms workstream – that adopted a multi-stakeholder approach to economic evaluation, with the remainder concerned solely with costs and benefits accruing to public bodies.

All ten studies found a positive return on investment. In one longitudinal study, the estimated gross value of telecare funded efficiencies over the period 2006-11 had a present value of approximately £78.6 million.[5] The methodological variations across the studies make it difficult to compare returns, even where they are looking at the same technology. It is our assessment that the studies likely underestimate the value of technology-enabled care as most placed an economic value on a narrow set of outcomes (see 3.2.2 below) and considered value creation solely to the government/health and organisations (i.e. quality of life improvements were generally not valued). A second observation, which is discussed further below, is the difference in approaches required for health interventions and for social care interventions. The former, most notably HMHM, tend to have more experimental research designs underpinning them. This recognises the fact that, as clinical interventions, they usually adhere to the standards of evidence-based medicine. This is in many cases not practical, useful, or appropriate for social care interventions. Section 5 sets out a framework for robust, yet responsive and timely, research around technology enabled care.

[5] http://www.jitscotland.org.uk/wp-content/uploads/2014/07/TDP-Final-Evaluation-July-2011.pdf

Box 1: Forecasted Economic Studies

Forecasted economic studies, such as cost-benefit analysis, predict the likely economic benefit of an investment. They differ from economic evaluations in that, rather than using actual data on outcomes, assumptions are used to estimate what is likely to take place in a given scenario(s). Forecasted studies can be useful before the start of a project or intervention to decide whether an investment is likely to represent value for money and are often central to constructing a business case for an investment. They have particular value in relation to interventions, such as technology-enabled care, where the main benefits are only observed at scale and so may not be captured in pilot project evaluations. As forecasts, rather than evaluations, they present different methodological issues and have not been included in the review of economic evaluations in this section.

The TEC programme has commissioned several high-quality forecasted economic analyses. One of these is a feasibility study by Deloittes for the provision of universal telecare services in Scotland. This modelled the costs and benefits of telecare provision for a range of uptake levels and care packages. This study estimates that, at the current level of provision for those aged 75+ (20% receiving telecare), the Scottish public-sector yields £99m in benefits (though the majority are not cash-releasing) in return for a £39m spend by local authorities. They further estimate that increasing uptake to 34% among those aged 75+ would cost an extra £33m to £38m and generate additional (non-cash releasing) annual benefits of between £85m and £102m. PA Consulting undertook a similar forecasted analysis to estimate the value of mainstreaming telecare provision in Glasgow. They estimate that transformation and mainstreaming of the service, which currently costs Glasgow Council £2m per year, could yield net in-year benefits of £3.2m. Such information can be helpful in making the case for further investment in mainstreaming provision.

3.2 Economic evaluation data review findings

3.2.1 Intervention Costs

Intervention costs are quantified differently across the ten studies. Several studies included only the cost of the equipment and its installation, while others included administrative costs and other overheads. Some studies included development costs where a project was new, while others used only the ongoing running costs. The most robust studies examined how the technological innovation under study impacts on care service use more generally and included this in the intervention cost (although this could also be captured in the quantification of outcomes).

3.2.2 Outcomes

Most studies placed an economic value on a narrow set of outcomes, and usually only considered the value accruing to public bodies from these (see 3.2.3 for further discussion of this). In some cases, only a single outcome was valued. For instance, the Western Isles video conferencing stroke clinic evaluation attached an economic value only to the number of bed days saved. Several others considered two or three outcomes. The Living it Up SROI evaluation was the only study to value a comprehensive range of outcomes to multiple stakeholders. Whilst it is understandable why studies would have sought to demonstrate a business case, adopting a narrow frame is likely to miss important sources of value.

Very few studies consider the value of both positive and negative consequences. For instance, some technology-enabled care applications may in fact increase the need for certain forms of care, particularly in the short term. This was considered in a minority of studies (e.g. York Economics study considered the additional care costs that come with enabling dementia patients to remain living in the community for longer).

3.2.3 Stakeholders

One study – the Living it Up evaluation in the digital platform workstream – calculates the value to multiple stakeholders. The remainder attach economic value only to outcomes that relate to the public sector, and usually only to changes in use of health and care services (e.g. visits to GP, avoided hospital or care home admissions). With several the studies pointing to quality of life and well-being improvements for recipients of the intervention – and this being one of the main aims of the TEC programme – adopting a multi-stakeholder approach to economic valuation would capture value more holistically and improve the quality of decision-making.

Valuing benefits to stakeholders other than the public sector is sometimes daunting. However, there are increasingly robust ways of undertaking such valuations. The key for TEC, if it is to endorse multi-stakeholder valuation, will be providing clear guidance to make this easier for evaluators and to ensure consistent approaches are adopted across studies, wherever possible.

In assessing the value of the interventions to the public sector, most studies are focused on changes in the use of health and care services and use unit costs (e.g. the cost of a day in hospital is used to value the number of reduced hospital days) to value these. Using unit costs in this way is useful if we are interested in how much resource can be reallocated. If there is an interest in the extent to which cashable savings are generated, TEC may want to investigate marginal costs. Note that over time, as a greater number of services are displaced by TEC, the value of changes at the margin will increase making them closer to unit costs and cash-releasing savings.

3.2.4 Study design and additionality

The validity and robustness of the economic evaluations depends in large part on the design of the evaluation study. The findings of the more general data review are relevant here. It is worth drawing attention to how the studies established the added value of the intervention (i.e. the change above and beyond what would have happened anyway). As noted earlier, experimental study designs are often not practical, necessary or appropriate when evaluating social care interventions. However, other methods of obtaining a benchmark or counterfactual may be required if the studies are to make robust claims about the value that has been created. This might involve controlling for national or regional trends or getting subjective assessments of attribution. In the ten reports reviewed for this section, several used a matched control sample (e.g. United4Health studies on diabetes, COPD, CHF). Others used data from prior time periods as a comparison (e.g. Falkirk Falls study), which can be a useful method of obtaining a counterfactual in the absence of having a control group. There are risks with studies that rely solely on reports by staff of key outcomes, such as avoided hospital admissions or reductions in length of stay (e.g. video conferencing trial for psychiatry services in care homes). While reports by staff are useful, they should wherever possible be triangulated with other data (e.g. historical comparisons; comparisons with other areas where a similar intervention has not been implemented). A challenge here is to separate out additional benefits of the programme from the workstreams/technologies. This would be a useful inclusion as part of future evaluations.

3.2.5 Discounting and sensitivity analysis

The use of a Social Discount Rate (SDR) is common practice in social cost benefit analysis and is recommended in treasury guidance (Treasury, 2003). Applying an SDR reduces future benefits by a certain percentage to express them in their present value. Discounting recognises that people generally prefer benefits today than having to wait for them in the future, and it compensates the current generation of taxpayers for this ‘patience’. In addition, it seeks to address intragenerational inequality as it assumes prosperity will rise, and that future generations will be better off and better able to make investments than we are today. SDRs can play a significant role in influencing investment decisions. Most of the studies reviewed here looked at interventions spanning several years, yet a majority did not apply a discount rate.

Sensitivity analysis is a process whereby key assumptions are varied to test how this effects the economic return. This is especially important for studies based on any weak assumptions. Six of the studies reviewed here undertook some sensitivity analysis.

Recommendations for ways to improve economic reporting are provided in Section 5.

4.0 Implementation research

A key finding from the data review (and other evaluations) is that, although many of the technologies have established an evidence base, there is more to be done on implementation and scale up. This has also been noted in the literature (e.g. Glasgow et al. 2013; Ossebaard and van Gemert-Pijnen 2016). Indeed, the TEC programme was designed to support implementation and we would expect it to form a central part of the ongoing research priorities. Our recommendation, therefore, is to explore the use of Implementation Science (IS) strategies to inform programme development and future evaluation. The TEC programme has had a key role to date in supporting implementation as set out in this report. In this section, we describe the findings from our exploratory implementation research. We cover the following:

- Introduction to implementation science, including key findings
- Report on the stakeholder engagement exercise with frontline and programme staff to explore the barriers and enablers to implementation, scaling up and sustainability
- The impact of the TEC programme on implementation so far, including strategies that have been used and any gaps
- The future research agenda for TEC in this area.

4.1 What is Implementation Science?

Implementation Science (IS) has become increasingly important to funders, researchers, programme developers and practitioners as an approach to bridging the gap between science and practice (Meyers, Durlak & Wandersman, 2012). This approach can be usefully applied to the Scottish TEC programme as it seeks to promote increased mainstreaming of technologies. The IS literature describes a broad landscape of theories, models, and frameworks that are used to examine a range of questions posed by IS practitioners (Fogarty International Center), including:

- How do you achieve more widespread use of effective practices, policies, and programs?
- What infrastructures or systems are necessary to ensure that dissemination and implementation are carried out successfully?
- How do organisations and practitioners build the capacity necessary to bring effective practices to scale community wide? (Wandersman, 2008)

The theoretical base for IS has developed from a diverse range of fields including Normalization Process Theory, Social Psychology, Systems Theory, Behavioural Science and Management. In the context of IS, implementation needs to be understood as a process that is complex and dynamic rather than

as a final outcome: “It is not a single ‘thing’ to be accomplished but operates within an interactive system made up of “many moving parts” (May, 2013 pp 2).

Implementation in TEC is complex, dynamic and influenced by multiple factors: professionals, patients/users, and the social, economic, organisational and political context. Complexity is exacerbated by the fact that the place of delivery increasingly includes informal care and the home environment (Ossebaard and van Gemert-Pijnen 2016). Furthermore, it is the interplay between technical and social factors that produce a particular outcome (Obstfelder et al. 2007). Successful implementation and the sustainability of innovations requires the barriers and facilitators that influence that context to be well-understood (van den Wijngaart et al. 2017). In addition, the nature of the interventions requires a strong focus on rapid evidence gathering and a fleet-footed approach to implementation, which is out of synch with the timescales of traditional evaluation methodologies (Glasgow et al. 2013, see also Section 5). As Ossebaard and van Gemert-Pijnen (2016, p.415) have written, “documented drawbacks such as low acceptance, low adoption or low adherence need our attention today to make the most of eHealth’s potential”. In a review of the implementation of the UK’s Whole System Demonstrator Project, Hendy et al. (2012) concluded that the implementation of a complex innovation such as remote care requires it to organically evolve, be responsive and adaptable but that this is not always aligned with the imperative to gather robust benefits evidence. For scaling up to be realised, this tension would have to be resolved.

IS and TEC are relatively new fields of scholarship and there is a limited, but growing, literature that brings the two together. There are several key points to note in this literature, including:

- Development, implementation and evaluation are deeply intertwined
- Stakeholder participation and co-creation is essential for effective implementation in technology-enabled care
- Digital technologies have the potential to create new procedures and infrastructures for healthcare delivery, which are not yet fully understood

4.2 Findings on barriers and enablers

The first step to identifying barriers and enablers to the adoption of technology-enabled care was to include this as a research question for the review of existing evaluations in Stage 3. The review found a considerable amount of information on barriers and enablers to implementation of telecare and HMHM. There was less research on this for video conferencing and digital platforms, reflecting the earlier stage of implementation for these technologies.

The data review was followed by two workshops to further explore these barriers and enablers as well as IS strategies. One workshop was attended by

frontline delivery staff; the other by workstream leads and TEC programme staff. At the workshop, attendees were asked to work through a list of common barriers in order to identify potential solutions. Tables 1 and 2 summarise the findings from the literature, which are consistent with those identified by workshop attendees.

Across both exercises, the most commonly identified barrier was staff resistance. There may be several factors influencing staff resistance and several potential methods for resolving it. Understanding the influencing factors is crucial to ensuring that the right implementation strategy is adopted. For example, if staff are struggling with competing workloads, specialist skills can be brought in to provide additional resource and to support them to ease the transition to the new system. On the other hand, if the main issue is a fear of change, a training programme addressing this directly might work best. Other noteworthy barriers include digital skills, infrastructure, lack of specialist skills, lack of interest from senior managers and a lack of interoperability. A further barrier that emerged from the workshop discussion was the lack of appropriate data. Attendees (mainly TEC Leads) described their roles as partly a 'sales job'. They require distinct kinds of data for different audiences and spoke of the value of data on effectiveness. However, concerns were also raised about the quality of monitoring data and the weakness in some existing data collection systems was raised as an additional barrier.

Table 1: Barriers to TEC implementation from the data review

Barrier	**How it manifests**
User resistance	• Misperception (e.g. that telecare is something only older people need) • User anxiety about using technology • Cost: Lack of awareness of benefits relative to costs
Staff resistance	• Concerns about the adequacy of technology and support • Concerns about increasing workload and changes to user/staff relationship (i.e. lack of face-to-face)
Digital skills	• Lack of skills to use system may mean it is not appropriate for everyone
Infrastructure, including connectivity	• Especially in remote and rural areas (but improving) • Connectivity presenting problems with submitting results from home monitoring • Lack of hardware for digital platforms rollout
Organisational barriers	• Restructuring affecting prioritisation and continuity of staffing
Lack of interoperability	• Switching between different systems, which may present a problem for users that are very dependent on routine or have low level tech skills
Lack of awareness Misunderstanding/	• Issue with some stakeholders not knowing TEC option exists • Failure to recognise that telecare is not just a 'quick fix'

misperception	• Missed opportunity to install telecare in the early stages of dementia when client is still able to learn
Funding/Procurement	• Complex procurement procedure • Recognition that implementation of HMHM is complex and requires more than procurement of the technology • Funding only for implementation, resulting in short-term contracts and failure to get best price
Lack of local authority collaboration	• Lack of universal approach may increase • costs and lead to duplication
Lack of management/clinical buy-in	• Lack of interest/resource • Lack of strategic or clinical leadership to support implementation
Difficulty accessing specialist skills	• Recruitment and retention issues - lack of continuity
Limited support/local knowledge	• Remote call centres don't understand context
Accommodation	• Certain types of accommodation not suitable e.g. housing associations

Table 2: Enablers to TEC implementation from the data review

Enabler	**Why?**
Good initial user experience	• Ensuring that HMHM is experienced as a responsive service by users • Recruiting users post-discharge rather than immediately following acute admission • Stakeholder engagement
Technology works well	• Intuitive technology that is a good fit for the user, local infrastructure • Results that are automatically uploaded (i.e. reducing typing errors) • Technology that can be personalised to the needs of the user • Simple protocols
Based locally	• Telehealth initiatives being based in community settings rather than hospital settings • Responders that have local knowledge
Management support	• Long term commitment to implementation of HMHM and, more generally, TEC
Adequate funding	• Charging kept to minimum
Sharing learning	• Local authorites collaborating to share learning and/or develop a universal approach
Training/awareness raising	• Wider health, social services and community workers • Staff (and client) training on IT, including training enough staff to ensure

	continuity • Managing user expectations (both client and staff) (e.g. through user information leaflets, staff training and so on • User training, including responsive tech support when there is a malfunction
Specialist skills	• Input from IT experts from the outset and investment in technology, equipment and infrastructure
Positive staff attitude	• Staff being positive about the introduction of technology and willing to undertake any additional work that may be required for its successful implementation
Good local connections	• This was repeatedly cited as one of the reasons for using a platform such as Living it Up.
Relevant up-to-date content	• Needs to be useful for clients (e.g. SmartCare platform)
Planning and evaluation	• Thorough planning, including clarity on roles and responsibilities of users and clinicians, and realistic timeframes and staff expectations from the outset • Continuous adjustment of service based on feedback
Readiness	• Organisational and workforce readiness assessment prior to implementation can flag potential issues before they arise

4.3 Implementation strategies in the TEC programme

The IS literature identifies four stages of implementation:

- Exploring and preparing
- Planning and resourcing
- Implementing and operationalising
- Business as usual

At each stage, different activities are required that are facilitated by distinct conditions. For the TEC programme, assessing progress against implementation is challenging. There are distinct, but interrelated workstreams, each at different stages of the implementation cycle. For example, video conferencing is still at the planning stage, whereas telecare is much closer to business as usual. Cutting across this, the programme is dealing with a range of populations with different sets of issues, creating another layer of implementation challenges. However, our research found that despite these complexities, the challenges also overlap (i.e. staff and users experiencing the same barriers and enablers across workstreams). This suggests that implementation, and increasingly evaluation, can be addressed programmatically.

The logic model workshops in Stage 1 show that the TEC programme is already employing many strategies that are consistent with recommendations in the IS literature. This was confirmed at the implementation workshop with workstream leads. At this workshop, participants were taken through a list of strategies to identify corresponding activities. This list of strategies was adapted from the work by Powell et al. (2015) on the Expert Recommendations for Implementing Change (ERIC) project[6].

Following the workshop, we refined and adapted the original list to fit with the Scottish TEC context. There were several steps to this. First, ERIC was an American initiative and we removed those that were culturally inappropriate (e.g. where they referred to health insurance). We then removed a small number that were repetitive and grouped the remainder where the strategies were similar or overlapped. This left us with 15 headline strategies with several sub-strategies within each. These are listed in Appendix 5.

4.4 Reflections on the impact of the TEC programme

The implementation research provided an opportunity to consider the impact of the TEC programme as a whole. During logic model development staff were keen to explore the programmatic impact, specifically whether there was any evidence that the programme was greater than the sum of its parts. Additional impacts, above and beyond the individual workstreams, were identified in developing the logic models but there were few evaluations that addressed this question directly with the bulk of the studies looking at technology impacts.

We used the implementation research to gather further information on the impact of the TEC programme. First, as discussed above, a substantial finding from the implementation workshops is that a large amount of formal and informal implementation work is being carried out applying strategies and methods identified as best practice in the international literature. Whilst the success of these has not been evaluated, it is clear that the approach taken is broadly consistent with the prevailing evidence of how best to develop such a programme.

In addition, workshop participants were asked to complete a survey, which explored TEC programme impacts from an implementation perspective. Respondents were asked whether they agreed with the statement that the

[6] This project synthesised strategies from a review of the health and mental health literatures as well as a variety of healthcare quality improvement initiatives within the U.S. Department of Veterans Affairs. They proposed 72 discrete implementation strategies (with varied levels of complexity) and gave recommendations on selecting implementation strategies appropriate to the service setting (Powell et al, 2015).

TEC programme team support them in implementation. All attendees ‘agreed’ or ‘strongly agreed’ (with most strongly agreeing) with this statement. The impact of the programme was also discussed in the workshop and attendees were broadly of the opinion that their work would not be possible without the support of the programme.

The additional evidence collected during the implementation research allows us to conclude that the programme is contributing, and further evaluation can inform our understanding of the size of that contribution. We explore some of the options for undertaking such research in the next section.

5.0 Measurement Framework

The difficulties associated with assessing TEC against the principles and requirements of traditional evaluation methods were raised by workstream leads at the outset of this study. This was especially an issue for interventions that sit closer to the health end of the 'health and social care' spectrum, where there is an expectation that studies will be experimental in design. This has led to high-quality non-experimental studies being rejected by clinical commissioners. In general, the need for a better understanding of the difficulty in using experimental methods in TEC and for an acceptance of the value, and complementarity, of other approaches was identified.

To this end, we propose a new approach to measurement for the TEC programme as it moves forward into the next phase of work. This builds on a conceptual framework developed by Glasgow et al (2013) to overcome the challenges of using traditional research approaches in the field of eHealth (which closely relates to the TEC programme). This field of research is still in development, and as well as making a direct contribution to technology-enabled care in Scotland, it presents an opportunity to make wider methodological and practical contributions.

Technology-enabled care interventions seek to transform the way in which health and social care are being delivered and our starting point is that this differentiates it from some other areas of health and social care that are more amenable to traditional evaluation. Technology-enabled care interventions require timely data, flexible and adaptable methodologies and attention to context. The Rapid Relevant Research Process (RRRP) is advocated by Glasgow et al. (2013) to respond to these requirements. It aims to be robust, pragmatic, relevant and more likely to produce results that will translate successfully into policy and practice than the traditional approach. The model is also deliberately non-linear, and emphasises an iterative, adaptive research process.

A further issue that differentiates technology-enabled care from other areas of health and social care is that it faces a set of unique challenges relating to implementation. These have been discussed in detail in the previous section. However, they are also relevant to evaluation. Whilst we know that there is considerable evidence for the efficacy of many of the interventions, there remains a need to fully understand the conditions under which they are effective, generalisable, sustainable, and cost-effective. Just Economics have proposed that Implementation Science (IS) frameworks could support the development of strategies. Each IS framework includes as a central feature a specific approach to evaluation. The measurement requirements may differ of these frameworks, but they share the need for early, ongoing feedback to support continuous refinement of the implementation approach. This is again consistent with the RRRP approach to evaluation.

5.1 The Rapid Relevant Research Process

Table 3 compares the RRRP with the traditional research pipeline. The issues that RRRP seeks to address are very relevant for the TEC programme. Whilst this is a break with evidence-based medicine (EBM), it is entirely consistent with approaches to evaluation that have long been used in social science, and related areas like social care. The approach is therefore not new but does provide a broad framework to direct and guide decisions on commissioning and conducting research. Furthermore, the approach has been developed in the health sector and its acceptability to a health audience is important if commissioners are to move beyond EBM approaches. The adoption of a broad framework will support a more consistent and strategic approach to evaluation is being used and that best practice elements such as stakeholder engagement are included.

Table 3: Comparison of traditional research pipeline with rapid, relevant research process

Issue	**Traditional Pipeline**	**Rapid, relevant research process**
Speed	Slow to very slow	Rapid, especially early on
Intervention and 'protocol' flexibility	'Frozen' early and standardised	Iterative, evolves, adaptive
Adaptation	Seen as bad – compromise to integrity	Encouraged and necessary to 'fit'
Designs Used	Predominantly RCT	Several, interactive, convergent
Costs and feasibility of research and products produced	Not considered, usually high	Central throughout, considered before, during and after, 'Minimum intervention needed for change' approach
Stakeholder engagement	Little and usually only respond to research ideas	Throughout, essential
Reporting	CONSORT criteria, primary outcomes, little else	Broad, transparent, perspective of adoptees
Role of context	De-emphasised, assumed independent of context	Context is central, critical and studied

Source: Glasgow et al. (2013)

We have expanded and developed the challenges presented in Table 3 into a set of principles to underpin the future approach to measurement in the TEC programme (see 5.3). These principles demonstrate how we envisage taking these concepts forward into practice. As much as possible, the principles draw on current approaches to measurement within the TEC programme, but

formalise these so that they can be applied systematically across the programme.

In advocating for the RRRP approach, we are not suggesting that experimental studies, such as Randomised Control Trials (RCTs), are never used to examine the efficacy of technology-enabled care. Instead, we are saying that such methods are unlikely to be the most appropriate for most evaluations undertaken by the TEC programme. This is especially the case as the programme moves to a greater emphasis on implementation, as set out in its strategic priorities for the next three years.

5.2 Measurement requirements emerging from the strategic priorities 2018-2021

The TEC programme has already achieved significant progress in many areas. As the programme moves into its next phase, there is still much to achieve, including ensuring that change takes place at scale, and becomes self-sustaining. The four key strategic priorities for the TEC programme from 2018-2021 are set out in Table 4, with the emerging measurement requirements highlighted for each, including how they map on to the RRRP approach.

Table 4: Measurement requirements for each strategic priority

Strategic Priority	Measurement requirement
Preparing for the future – identifying and testing new approaches that offer the potential to achieve change at scale	Rapid, robust and pragmatic evaluation and 'tests of change' that identify new approaches that could be used at scale. These should 'demonstrate measurable improvement in outcomes either directly to individuals or indirectly through improved service delivery processes'. Flexible and adaptive methodology, which ensures that learning can continuously inform the ongoing design of the approach. The methodology should also produce results which highlight key issues that will inform roll out at scale.
Developing approaches once for Scotland – developing approaches that have been shown to be effective, supporting scaling up across Scotland and addressing barriers that require national level action	Research methodology that: focuses on understanding the impact of context and setting, highlights issues/results which are key for future adopters, such as barriers and enablers to successful implementation. Supports and enables collaboration at all levels
Building capabilities and supporting improvement – championing, supporting, gathering and promoting the evidence of what works, to develop the culture and skills that recognise and use digital TEC including	Methodology that produces results which are easy to share, readily translatable into policy and practice, and include a rich mix of qualitative and quantitative data.

through developing business cases, supporting strategic planning and delivery.	
Transforming local systems – supporting exemplars that are seeking to transform local health and social care systems using digital technology to shift local systems upstream to prevention, self-management and greater independent living.	Rapid, robust, pragmatic small-scale evaluations of local exemplars demonstrating achievement of short and medium-term outcomes as set out in the logic models. A flexible and adaptive research design, so that learning can continuously inform the project's ongoing design and performance (including capturing learning from the early stages).

5.3 Measurement principles

The following nine principles have been developed from the RRRP framework and the evaluation requirements emerging from the strategic priorities for the next three years. Many of these principles are already being applied. We collect them here to ensure that they are adopted consistently in future measurement and evaluation.

Principle 1: Be strategic

Evaluations should add value and be cost-effective

Evaluation resources should be carefully deployed to ensure that they are addressing gaps. Where evidence already exists, even if it has been collected outside the TEC programme, evaluation should not seek to repeat this. There will be exceptions, for example where research took place in a different context, which may affect the results, but there should be a clear and specific rationale for doing so (e.g. if it is intended to have policy influence). Although Scotland is at the forefront of technology-enabled care development and evaluation, it is a rapidly expanding area of research. The programme should keep abreast of the latest international research. Regular research digests could both inform staff and provide them with support in their day job (e.g. where evidence demonstrates the efficacy of their approach).

Strategic decisions should also be guided by cost-effectiveness. Methods which are costly or time-intensive may not be the most appropriate, if information can be gathered by other means. To this end, the programme may want to consider bringing more evaluation skills in-house. A staff member with partial oversight of evaluation could support delivery staff in the field with their evaluation requirements as well as carry out some research tasks, such as reviews of the international literature and managing the collection of monitoring data. This could be combined with commissioning of external research in areas of specialist skill, such as systematic reviews, Implementation Science or economic analysis.

Principle 2: Plan and Scope

Each evaluation should be carefully planned and scoped

Once an area of evaluation is chosen, it will require careful planning to ensure a good research design and appropriate scope are chosen. Well-planned evaluations can still encounter problems and require refinements to design, scope or research questions. Good planning minimises the risk of this. We have developed the following checklist for use in the planning phase to ensure that an appropriate design and scope are chosen (some are developed further in the principles that follow):

1. Why is the evaluation being carried out? How will it support the achievement of the Strategic Priorities?
2. What are the specific research questions that need to be addressed?
3. What research method will be most appropriate to answer those research questions? (Principle 4)
4. How quickly do the results need to be available? How does this inform the research design? (Principle 5)
5. Will the findings provide new evidence or information, or is it repeating what has already been done? Can new variables be included? (Principle 1)
6. Is the research method sufficiently iterative, adaptive and flexible? If not, is there a sound argument for choosing it? (Principle 6)
7. What are the cost implications? How can the evaluation be run most cost-effectively? (Principle 1)
8. Does context matter for the evaluation and if so, how should this be incorporated into the design? (See Principle 7)
9. Who are the key stakeholders and how will they be involved throughout? (Principle 8)
10. For an outcomes evaluation, is it appropriate to incorporate questions regarding implementation, sustainability and economic impacts? (Principle 1)
11. How can the process of data collection and automation be streamlined and efficient, whilst minimising potential for error? (Principle 9)

Principle 3: Measure what matters

There are three aspects to this principle: (a) measure outcomes; (b) measure things relevant to people; and (c) ensure that indirect effects/externalities are captured.

Although the language of outcomes is now commonplace in the measurement of public and charitable services, the term is often used loosely to describe things that are outputs, indicators or process measures. Decisions about what constitutes an output, outcome, or indicator may vary in different situations. For example, something that is considered an output of one of the workstreams may be an outcome of the programme and vice-versa. In any

logic model, the set of outcomes should work together to provide an overall picture of the impact the intervention is having. As a set they should be comprehensive, clear, incommensurable (be measuring different things) and irreducible (be referring to only one concept).

To ensure that you are measuring things that are relevant to your stakeholders, it is important to coproduce research with them. Coproduction in research is not a new idea and forms the basis of approaches such as Action Research. The idea is that stakeholders have greater control over the research process and are provided with opportunities to learn from their experience. It is more than simply a data collection exercise (see Principle 8).

A benefit of coproducing research with your stakeholders is that it ensures that all significant outcomes are being identified, including indirect or unintended ones. Where possible, evaluations start with an open question as to the outcomes, rather than focusing on a predetermined set out of measures. This holistic approach ensures that unexpected outcomes are considered in the research design.

Principle 4: Methodological Plurality

The most appropriate methodology/approach should be chosen from a range of options

There are many different evaluation methods and approaches. No single approach or method is appropriate to all situations, nor is any intrinsically better than another: they all have strengths and weaknesses and work more or less well in different contexts. For one-off evaluations – in contrast with systematic monitoring – employing a range of approaches across the programme gives richness to the data, and should provide flexibility, which as discussed is an important requirement in the evaluation of technology enabled care.

One key decision is whether to use qualitative, quantitative or mixed methods approaches. Ideally, the chosen approach should be the best fit for the research questions being asked and the evaluation's overall aims. However, this will need to be balanced with issues of cost, data availability and feasibility (see Principle 1). The need for pragmatism will sometimes mean that a 'second best' approach is chosen. Table 5 below sets out where qualitative or quantitative approaches may be most useful:

Table 5: Comparison of qualitative and quantitative methods

Qualitative methods help to:	Quantitative methods help to:
Develop or refine your research questions Understand feelings, perceptions and attitudes Capture the language used to describe services or products Generate ideas for improvements Understand context in depth Interpret findings from quantitative data Develop hypotheses which can then be tested using quantitative data	Test hypotheses or theories developed through qualitative research Understand effects at scale of a service or product Generalise results to a wider population Find patterns or trends emerging from a large amount of data Generate statistically significant results

It is often useful to begin with qualitative research, or stakeholder engagement, to refine the research questions, understand the context and generate specific hypotheses (such as a logic model or an outcomes framework) that are then tested through quantitative research. A final stage of qualitative research is sometimes used to help interpret and understand the findings from the quantitative research and support its dissemination. This approach is widely used and underpins designs like theory-based evaluation (Weiss, 2000), realistic evaluation design (Pawson and Tilley 2006), contribution analysis (Mayne, 2001) and Social Return on Investment (Nicholls et al. 2010). Similar to the RRRP approach, these emphasise context and its impact on the causal chain. However, such mixed method studies can be time consuming and sometimes costly, and any given study may focus purely on one or other approach, depending on the evaluation requirements, complexity and budget.

Principle 5: Timeliness

Evaluation findings should be available in a timely fashion

When planning an evaluation, the likely time lag for any methodology should be considered alongside the time scale within which the results are needed. As discussed, there is typically a considerable time lag involved when using experimental research designs such as RCTs. In the context of technology-enabled care, where the technologies under study are rapidly evolving, this delay may mean the findings are all but obsolete by the time of publication.

If data are required quickly, short cross-sectional, online surveys can be used, or interviews conducted by telephone, video conferencing or SMS. The

development of survey templates, interview guides or other ‘off the shelf’ approaches may be helpful for managers who need data in a timely fashion and reduce duplication of effort. It may also be appropriate to construct a panel of TEC users that can be returned to regularly at short notice to test out ideas. This process could be furthered by the development of better, more systematic outcomes monitoring linked to the logic models for each workstream. Survey templates could be developed that address indicators at each link in the causal chain. These could then be utilised depending on the stage of the project life cycle. The use of templates generally will reduce the amount of time that delivery staff must spend on evaluation.

Principle 6: Flexibility

There should be a focus on evaluation methods, which are iterative, adaptive and flexible

As mentioned above, the rapid evolution of technology in the field of TEC has implications for evaluation. As well as providing rapid results, the evaluation method needs to support the process of continuous learning by providing feedback loops. For example, if there are early indications that an approach to implementing a new service is not working, the evaluation should (a) provide the data to demonstrate this in a timely fashion and (b) adapt to take account of changes that are required to overcome this. This may involve abandoning an evaluation at the point where something is found not to work or making a recommended change and then re-evaluating its impact. As such, the overall evaluation of technology-enabled care is likely to be iterative, rather than linear. The focus should be on ensuring that the information gathered through evaluation supports the achievement of the Strategic Priorities. The evaluation methods and approaches should be continually adapted as needed to fulfil this aim (i.e. those agreed at the planning stage should not be rigidly adhered to if it later transpires that they are no longer the most appropriate method/approach/indicator).

Principle 7: Context matters

Context should be central, focused on and reported

A key difference between the RRRP and the traditional approach is the importance of context. It shares this with the theory-based approaches set out in Principle 4. Evaluation plans should demonstrate how they will ensure that context is considered, and evaluation findings should, wherever appropriate, include an understanding of how the context may have influenced the results. For example, in an intervention aimed at scaling up video conferencing, the evaluation needs to account for the digital skills of the population and infrastructure quality if it is to understand why the intervention was successful or otherwise. Unless considered at the planning stage, there is a risk that causal inferences will be misunderstood.

Context is especially important for implementation and demonstrates the need to incorporate implementation into the testing of the logic model. When developing a logic model, context may be explicitly identified or expressed as part of the discussion of the assumptions that underpin it.

Principle 8: Involve stakeholders and clients/citizens

Stakeholders should be involved throughout

In evaluation, 'stakeholder' refers to any group or entity that affects an intervention or is affected by it. The involvement of stakeholders at the planning stage ensures that the evaluation measures things that are most important to those directly experiencing the change and multi-stakeholder approaches are now commonplace in many types of evaluation. Not all stakeholders are of equal importance and the relevance of any stakeholder group to the analysis needs to meet a materiality test if they are to be included. This materiality test asks whether sufficient benefit is likely to have been created for that group, relative to the whole, to merit its inclusion in the analysis. The aim is to focus the logic model on the most significant outcomes, where omission would influence decision-making.

Engaging stakeholders generally begins with a mapping exercise to ensure the analysis is sufficiently holistic and that indirect effects are captured. Engaging stakeholders ensures that:

- Context is well-understood
- The logic model is relevant to all material stakeholders
- Measurement tools are well-designed and meaningful to participants
- Data on barriers and enablers can be gathered quickly and cost-effectively
- Short-term recommendations for improvements can be made and acted on quickly

Stakeholder engagement is essential for smooth implementation. It also establishes a two-way communication channel between those initiating change and those affected by it. A further benefit is that it requires the use of participatory methods which can be empowering for staff and service users who may want to know their issues are being heard.

It is sometimes necessary to segment stakeholders to ensure that the logic model is coherent. This happens when materially different outcomes are identified for sub-groups of stakeholders, which will require distinct measurement. For example, different users of telecare will have a broadly similar logic model, but their outcomes may be sufficiently different (e.g, care home clients with dementia compared with a young person with a physical disability living alone) to merit distinct measurement.

Principle 9: Use technology

Data collection and analysis should be automated where possible

Data collection and analysis can be very time consuming, as well as susceptible to human error and bias. Using technology to support measurement reduces the risks of human error (e.g. from data being inputted incorrectly) and can be less resource intensive. Moreover, TEC has a unique opportunity to incorporate data collection into the design of technologies so that data on outcomes, economic impacts and implementation is routinely gathered. In time, this could be facilitated and coordinated by the digital platform so that technologies can be programmed to produce real-time data for different aspects of the logic model. Although largely aspirational at this stage, it is important that the design and deployment of existing and future technologies makes full use of their data collection potential.

In the short term, there are several things that can be done to ensure technology supports evaluation. TEC Programme staff told us that they find collating monitoring data time consuming and that there are issues with how consistently people are recording data. There is potential here for the use of technological approaches, such as online systems for data gathering, a greater use of templates and guidance on how these are reported. Finally, much of the current monitoring data that is output-focused could be extended to include data on outcomes, economic impacts and implementation. However, this could only be achieved if the process is simpler and more streamlined. Practical ways that this could be achieved are addressed under the recommendations.

5.4 Recommendations for future measurement and evaluation

In this section, we provide practical recommendations of steps that could be taken to work towards the achievement of the nine principles set out above. Some are high level recommendations on the approach to evaluation – the 'how' to measure, and others are recommendations on evaluation content – the 'what' to measure. These are cross-cutting recommendations drawn from all the research activities carried out as part of this project. There is no hierarchy as such, but some will require a larger scale/resource level (e.g. implementation) than others (e.g. quality of life impacts).

1. **Adopt the RRRP approach to evaluation**

We recommend that the Scottish Government formally adopts this approach and uses the nine principles set out above to guide evaluators. In many instances, this is what the workstreams are already doing. Formalising the approach provides academic and methodological credibility for work that is already being undertaken. In addition, whilst it is generally consistent with existing practice, more could be done to strengthen elements like stakeholder

engagement. As part of this we would recommend building economic analysis more routinely into evaluations. In a break with traditional cost benefit analysis, this would mean that economic studies would not be limited to cases where experimental data are available but would be considered with a wide range of study types and methodologies. Finally, it would be useful to document the process of adopting and developing the RRRP as this will increase its legitimacy as well as contribute to a process of ongoing learning and development.

2. Prioritise implementation and the impact of the TEC programme

Much of the evaluation to date has focused on the technologies at the workstream level, rather than the programme as a whole. In future evaluations, and as the programme matures, it will be helpful to shift the emphasis on to the impact of the programme, despite the continued existence of data gaps at the workstream level. This need was also highlighted in Hudson's evaluation of the first year of the programme (Hudson, 2016).

Given that the programme focuses largely on implementation, this will be facilitated by a greater focus on evaluating this area. From the exploratory research in this study, we recommended exploring the following evaluation options.

a) Scoping research on implementation needs and the effectiveness of existing strategies.

Implementation has already been addressed as part of evaluations to date (e.g. Lennon et al. 2017 to identify success factors), including other work in Scotland and prior to the TEC programme commencing. Indeed, the programme was initially based on a review of implementation in telehealth and telecare. Nonetheless, this has been identified as an area that requires ongoing investigation with a view to identifying the most significant barriers (and new barriers as they emerge) and crucially the most useful implementation strategies to address them as the programme shifts to national scale up.

b) Identification of an IS framework for future TEC rollouts.

Implementation Science is best applied proactively at the planning stage, rather than retrospectively. There are about 60 IS frameworks in existence, but none specifically for TEC. Some frameworks, like Re-Aim, have been used by other researchers in the ehealth (including telehealth) field (Glasgow et al., 2013). It is recommended that the programme use, or adapt, an existing IS framework in future project planning and evaluation that can support both national and local implementation and contribute to the implementation of the new Digital Health and Care Strategy.

Further research is required to determine which framework is best suited to TEC. Questions that would need to be addressed are whether a) one would be comprehensive enough for the whole programme at both national and local levels, or whether separate ones are required for specific workstreams and b) whether an existing framework would be sufficient or whether a bespoke approach is required.

c) Evaluating the success of the implementation framework.

Should an implementation framework be selected, it will be important to evaluate its effectiveness. This could involve routine examination of service audit information, quality monitoring, feedback from frontline staff and service users and regular mixed method reviews of progress. This would be highly beneficial for the programme and the future development of TEC and wider digital health and care priorities in Scotland. It would also be of wider academic, policy and practice interest, and contribute further to innovation in technology-enabled care.

3. Conduct a review of monitoring data capture and use evaluation to address gaps in the logic models

The way in which monitoring data is captured should be reviewed. Alongside this, a long-term plan for automating data collection should be developed as well as a short/medium-term plan for the interim. This would seek to address the inconsistent and time-consuming nature of existing data collection and explore how to better support this. We recommend increasing the use of technological solutions where possible. Assuming a better system can be developed, this should seek to extend what is being captured to include outcomes, economic, and implementation data.

Evidence matrices have been developed for each of the workstreams and the overall programme, which compare the existing evidence base with the outcomes identified in the logic models. This is a systematic way of identifying gaps in the evidence and could be used to guide decisions on future evaluations.

4. Adopt a more consistent approach to evaluation, especially economic evaluation

In general, the programme could benefit from more consistency in how evaluations are approached. This would enable comparison but also improve the quality of evaluations by ensuring that good indicators and approaches to data collection are shared across projects. However, consistency is especially important for economic evaluations. This could be improved by adopting a

standardised approach to the measurement of outcomes, wherever possible.[7] This could include the development of a bank of indicators and values that enable measurement and valuation to be undertaken more easily for multiple stakeholders and in the same way across different studies. This will make it easier to aggregate and compare results, or at a minimum read across different studies.

The logic model work undertaken for the interim report provides a strong foundation for developing a common indicator bank. This could be based on guidance such as the GDS Digital Inclusion Evaluation Toolkit developed by Just Economics. Such an approach could be tailored for economic evaluation with more sophisticated modules where a higher standard of evidence is required. Consistency around values is also important. Several studies used the ISD costings (http://www.isdscotland.org/Health-topics/Finance/Costs/) and these could be incorporated into any guidance that is developed along with the costings on social care for England by the PSSRU (http://www.pssru.ac.uk/project-pages/unit-costs/).

5. Develop guidance, in-house skills and a microsite

To improve consistency and ensure high quality approaches are used, the programme would benefit from developing bespoke guidance for the TEC programme. This would include templates for evaluation, surveys, interviews and guidance on economic analysis and other 'off the shelf approaches' that are consistent with the RRRP.

This also applies to economic analysis. In principle, studies currently follow Treasury Green Book guidance. However, this is sometimes patchy (e.g. the use of discount rates). In addition, programme-specific guidance could be more tailored and contextual. This would improve the quality of analyses, for example by recommending the most appropriate discount rate or benefit period for a given context. Areas where economic guidance would be useful include:

- Identifying intervention costs
- Establishing additionality (especially for 'softer' outcomes)
- Unit vs marginal costs
- Discount rates and sensitivity analysis

To host these materials, we recommend the development of a microsite specific to the TEC programme. This would act as a 'one stop' resource hub for technology enabled care evaluations. To manage this site and the

[7] Consistent use of assumptions and values should be a goal of any future evaluation, although there will be instances where the specificities of the intervention or local context will mean that a study may have to diverge from the standardised measures.

guidance development, we recommend fostering some in-house evaluation skills within the TEC programme (e.g. a part-time staff role). This person could also support evaluations of delivery staff. Finally, they could be responsible for keeping abreast of the latest international research and disseminating this internally.

6. Conduct more multi-stakeholder research

Evaluations to date have tended to focus on a single stakeholder, even in contexts where there are multi-stakeholder impacts. We recommend taking a wider approach, which is again consistent with the RRRP. This is especially important for economic evaluations to ensure that benefits are being measured holistically. In our review, only one in ten studies adhered to this even though it is considered a best practice approach (Treasury, 2003). This is a further area where bespoke guidance may be beneficial.

Two stakeholder groups that would merit a greater focus in research are paid staff and unpaid carers. Although qualitative research exists in some of the workstreams, the evidence base could be strengthened. As discussed, staff resistance was one of the most cited barriers to successful implementation by research participants. There is also scope for research at the programme level given the fact that workforce issues are common to all workstreams. For example, the work on implementation could have a special focus on determinants of staff resistance and the use of strategies to overcome them, especially for workstreams that are at an earlier stage in the implementation cycle. Carers are important for outcomes and process evaluations as they benefit from the programme but are also essential to successful implementation. Evaluations could be scoped to measure carer impacts more routinely. Key metrics would relate to carer feelings of support in their caring role, how burdened they feel and their own quality of life.

7. Further research on future benefits, sustainability and mainstreaming

There are two types of sustainability relevant here: sustainability of service models using technology-enabled care and sustainability of the outcomes (i.e. the benefit period for outcomes). The first is concerned with whether people cease to use a technology over the time and the second is concerned with whether the technology use continues to provide them with the initial benefit. In economic studies, we would describe this as the ‘benefit period’. Due to the early-stage nature of the programme, much of the evidence is still short-term and it is difficult to answer these questions with existing data. The exception is telecare, which is building on many years of previous work. Although not a major challenge, there is some evidence of users discontinuing with a technology, which merits further research. There may be scope for tracking users over time to understand better the duration of outcomes and recidivism, or the reasons that people cease to use a technology enabled care

intervention. This will be important for economic studies that want to project benefits into the future or understand the rate at which benefit declines over time.

An additional future impact is to understand the point at which a technology becomes mainstream. This would include some exploration of what constitutes 'critical mass' for each technology. This links to questions of when a technology to have been fully implemented and there is no further need for a TEC programme. This may also help identify the most promising set of activities to achieve mainstreaming.

8. More research on some secondary outcomes

Unsurprisingly, the evaluations have tended to focus on the primary outcome of a technology, often a clinical or care outcome. However, there are some gaps relating to secondary outcomes, which could benefit from some further research. The two we highlight here are quality of life/well-being impacts and health inequalities.

Improving the well-being of clients is central to the TEC programme, yet in some instances there is a more limited understanding of the impact of using technology-enabled care on quality of life. This was also highlighted as a need by Hudson's Year 1 evaluation (2016). There are exceptions with some areas such as telecare. However, there may be scope for building these impacts into evaluations more routinely, as well as exploring the most appropriate types of quality of life measures to use for research with TEC beneficiaries. This is an area that workstream leads have identified as requiring further support, drawing on best practice from the science of well-being measurement.

Measuring health inequalities is challenging but it is important both because of the potential for technology-enabled care to address health inequalities, and the risks that it will reproduce some of the inequalities associated with digital exclusion. We recommend the programme undertakes research to examine how it can ensure equality of access to technologies. For example, such a study might consider what steps might be taken to mitigate such inequalities being exacerbated through systems like digital platforms.

6.0 Conclusions

The TEC programme has achieved much in the three years of work that have been considered as part of this evaluation. Although building on previous work, especially in telecare and HMHM, the programme includes a sophisticated set of complementary and well-developed technologies that are beginning to change the way in which health and social care are being delivered in Scotland.

The purpose of this evaluation was to draw together and synthesise the existing research produced under the auspices of the TEC programme. From the outset, we adopted a flexible approach to respond to any unexpected findings. During the research our analysis identified implementation as an area that merited further exploration and an additional module of work was introduced. For some of the workstreams, evaluations have served their purpose of developing an evidence base to promote adoption, and the next phase of work will focus more on the barriers and enablers to implementation and the issues with achieving change at scale. Due to the large network effects of the interventions, achieving change at scale is important because the value of the technologies increases with the number of users.

In this final section, we reflect on the research questions we presented at the outset and what we can conclude for each.

1. **What is the range of the existing evidence and data on the TEC programme? What is the quality of that evidence and where are the key gaps for both range and quality?**

The TEC programme has produced a sizeable number of good quality evaluations, which are varied in terms of methodologies, geographies, stakeholders included, and issues considered. There are some clear patterns. The largest and most detailed studies exist within the workstreams that are at the furthest stage of implementation (i.e. HMHM and telecare). The focus in both video conferencing and digital platforms has been on developing, testing and deploying of technology and infrastructure to support those workstreams, and there are consequently fewer, smaller-scale evaluations.

Although the evidence base is strong for many outcomes, there are some gaps. Studies have tended to focus on one stakeholder group and there are gaps relating to groups like carers, or some conditions. Other gaps that have been identified are outcomes for the workforce, quality of life impacts for some groups, potential negative impacts such as health inequality and implementation. A series of workstream-specific recommendations have also been made.

Almost all of the evidence generated relates to the workstreams, rather than the programme as a whole. However, our study has tentatively explored

whether there were programmatic impacts, above and beyond the individual workstreams. We concluded, albeit based on small-scale evidence, that it is unlikely that the interventions could exist without the programme support. Indeed, a first step in technology-enabled care implementation is the development of a structured, funded programme of work.

2. **What do we know about the barriers and enablers to effective implementation of TEC?**

There is a considerable amount of information on barriers and enablers to implementation although more in relation to HMHM and telecare than the other workstreams. We also found despite diversity and complexity, that there was much similarity across the workstreams, suggesting that this is an issue that could be successfully tackled programmatically.

Across all areas, the most commonly identified barrier was staff resistance. Other noteworthy barriers include digital skills, infrastructure, lack of specialist skills, lack of interest from senior managers and a lack of interoperability. A further barrier that emerged from the workshop discussion was the lack of appropriate data. Staff require distinct kinds of data for different audiences and spoke of the value of data on effectiveness. However, concerns were also raised about the quality of monitoring data and the weakness in some existing data collection systems was raised as an additional barrier.

3. **Once TEC is implemented, what do we know about how sustainable its use is over time?**

For telecare, data is available on sustainability from the 2006 development programme. However, this was more limited in other areas. This is to be expected from a relatively new intervention and programme, where longitudinal data are limited. It is an area that we recommend the programme focus on for future research, and we have identified sustainability of use and sustainability of outcome as two discreet evaluation considerations.

4. **What is the state of knowledge on cost effectiveness? How is cost-effectiveness taken into consideration when scaling-up an approach – what is the standard of evidence used? How is cost effectiveness compared against clinical effectiveness and personal outcomes?**

There is a reasonable amount of evidence that TEC interventions are (or have the potential) to be cost effective. It is clear that telecare and HMHM can lead to reductions in demand for hospital beds and care homes/care at home, which have direct economic values. However, as discussed earlier, the value of these is small at the margin and the unit costs of bed days may overstate the actual savings generated. Nonetheless, the potential value has been demonstrated and should be realised at scale. In terms of methodological

rigour, the studies are broadly of good quality. However, they are narrow in scope and tend not to compare intervention costs with personal or clinical effectiveness. A series of recommendations to improve the consistency of studies has been made.

5. **What are the longer-term monitoring and evaluation requirements to support the on-going development and delivery of TEC? Are there standardised metrics that can be recommended for some grantees to report against that would support the development of the evidence base?**

The report has developed a measurement framework and set of evaluation principles based on the RRRP approach. This is combined with a set of workstream specific recommendations and recommendations for implementation and economic research. Increasingly, the programme should seek to incorporate economic and implementation considerations into evaluation. There is also scope for standardisation across all areas of research. This could be achieved by the development of bespoke guidance tools that could be hosted on a microsite and managed internally by staff with specialist evaluation skills.

Finally, the programme should seek to build on the successful approaches it has already adopted, not least an emphasis on the importance of evaluation, which not only make the policy case for the social value of TEC but also supports frontline staff – a key constituency in scaling up – to promote the benefits locally.

As the programme moves into the next phase, there is a clear opportunity to use the latest thinking on TEC evaluation and implementation to improve take-up in Scotland and solidify international leadership in this area.

Bibliography

This section includes all primary and secondary sources consulted during this evaluation. The primary sources have also been divided into those that are published and unpublished sources

Primary published sources

1. Alexander, H. (2017) Technology Enabled Care: Home and Mobile Health Monitoring National Evaluation: First Contribution Story.

2. ALISS Access to Local Information to Support Self-management 2009-2013 Report 1. Retrieved from https://www.alliance-scotland.org.uk/wp-content/uploads/2017/09/Alliance-ALISS-Report1.pdf

3. ALISS Access to Local Information to Support Self-management 2013-2016 Report 2. Retrieved from https://www.alliance-scotland.org.uk/digital/wp-content/uploads/2017/09/Alliance-ALISS-Report2.pdf

4. Barber, M., Frieslick, J., Maclean, A., Williams, J. and Reoch, A., 2015. The Western Isles Stroke Telerehabilitation (Specialist Medical Consultation) Service–implementation and evaluation. European Research in Telemedicine/La Recherche Européenne en Télémédecine, 4(1), pp.19-24.

5. Broens, T.H., Huis in't Veld, R.M., Vollenbroek-Hutten, M.M., Hermens, H.J., van Halteren, A.T. and Nieuwenhuis, L.J., 2007. Determinants of successful telemedicine implementations: a literature study. Journal of telemedicine and telecare, 13(6), pp.303-309.

6. Brown (2016) TEC – Test of Change Report. Highland Hospice.

7. FarrPoint (2015) Feasibility Study: Telecare in Scotland Analogue to Digital Transition. Retrieved at https://sctt.org.uk/wp-content/uploads/2015/12/NHS24D3V3_0-Final-Report-Updated-12th-Oct-2015.pdf

8. Hall et al. (2016) Evaluation of video conferencing in care homes: technology enabled clinics in older adult psychiatry. University of Highlands and Islands. Retrieved from https://sctt.org.uk/wp-content/uploads/2017/05/TEC-Care-Homes-Evaluation-Final-Report-December-2016-1.pdf

9. Hearty, M., Aitken, L. and Alexander, H. (n.d.) Home & Mobile Health Monitoring of Blood Pressure as an alternative to attending General Practice. NHS Lanarkshire & TEC.

10. Impact Generation (2015) An Evaluation of Living it Up, a Self-Management Hub for those aged over 50 with a Long-term Condition/s and/or Carers'. Retrieved from https://sctt.org.uk/wp-content/uploads/2016/08/FINAL-Practitioner-Survey-Report.pdf

11. Jarrold, K. and Yeandle, S., (2011). 'A weight off my mind': Exploring the impact and potential benefits of telecare for unpaid carers in Scotland. Retrieved at https://www.carersuk.org/scotland/policy/policy-library/a-weight-off-my-mind

12. Lennon, M.R., Bouamrane, M.M., Devlin, A.M., O'Connor, S., O'Donnell, C., Chetty, U., Agbakoba, R., Bikker, A., Grieve, E., Finch, T. and Watson, N., 2017. Readiness for Delivering Digital Health at Scale: Lessons From a Longitudinal Qualitative Evaluation of a National Digital Health Innovation Program in the United Kingdom. Journal of medical Internet research, 19(2).

13. Milsom (2015) Home health monitoring: critical success factors for implementation A narrative synthesis of evidence. Retrieved from https://ec.europa.eu/eip/ageing/sites/eipaha/files/results_attachments/home_health_monitoring_-_critical_success_factors_for_implementation.pdf

14. Newhaven Research (2011) Telecare Development Programme in Scotland 2006-2011. Retrieved from http://www.jitscotland.org.uk/wp-content/uploads/2014/07/TDP-Final-Evaluation-July-2011.pdf

15. Scottish Government (2017) Social Care Services Scotland 2017 [Statistical Bulletin] Retrieved at: http://www.gov.scot/Topics/Statistics/Browse/Health/Data/HomeCare

16. Smartcare (2016) Taking positive steps to prevent trips and falls. Retrieved at https://sctt.org.uk/wp-content/uploads/2016/09/PH2257-SmartCare-in-Scotland-Report_24_08_16-2.pdf

17. TEC (2017) Home & Mobile Health Monitoring Resources. Retrieved at https://sctt.org.uk/wp-content/uploads/2017/12/TEC-HMHM-National-Resources-V1-1.pdf

18. United4Health (2015) UNIversal solutions in TElemedicine Deployment for European HEALTH care Summary Report. Retrieved at https://sctt.org.uk/wp-content/uploads/2017/05/D1.8-v1.2-United4Health-Final-Report.pdf

19. United4Health (2016) UNIversal solutions in TElemedicine Deployment for European HEALTH care: Deliverable D6.7 Final Trial Evaluation – Diabetes. Retrieved at https://sctt.org.uk/wp-content/uploads/2017/05/D6.7-v1.4-United4Health-Final-Study-Evaluation-Diabetes.pdf

20. United4Health (2016) UNIversal solutions in TElemedicine Deployment for European HEALTH care: Deliverable D7.7 Final Trial Report – COPD. Retrieved at https://sctt.org.uk/wp-content/uploads/2017/05/D7.7-v1.4-United4Health-Final-study-evaluation-COPD.pdf

21. United4Health (2016) UNIversal solutions in TElemedicine Deployment for European HEALTH care: Deliverable D8.7 Final Trial Report – CHF. Retrieved at https://sctt.org.uk/wp-content/uploads/2017/05/D8.7-v1.3-United4Health-Final-study-evaluation-CHF.pdf

22. United4Health and SCTT (2017) Deployment of Telehealth at Scale. Retrieved at https://sctt.org.uk/wp-content/uploads/2017/06/U4HLessonsLearnedReportScotland2017.pdf

23. York Health Economics Consortium, 2013. Telecare for people with dementia: evaluation of Renfrewshire project: final evaluation report. York: York Health Economics Consortium.

Primary unpublished sources

24. Angus Health & Social Care Partnership (2016) Community Alarm Improvement Project in Angus H&SC Partnership Interim Report (unpublished)

25. Craig, J. (2013) Evaluation of Falkirk Falls Management Project and Extension in 2010/11. Falkirk Council Social Work Services (unpublished)

26. Deloittes (2017) Telecare Feasibility Study: Feasibility study for the provision of universal telecare services for the over 75s (unpublished)

27. Digital Stories Outline – Technology Solutions (Jill O'Boyle and Greg Pawelczyk) (unpublished).

28. Diasend Project (United4Health) Evaluation (unpublished).

29. Grant, J (2017) HMHM Evaluation Case Study NHS Ayrshire & Arran Florence Hypertension Monitoring (unpublished)

30. Keeney, E. and Callaghan, S. (2012) East Ayrshire Community Health Partnership Economic Evaluation of Telehealth as part of the management of Chronic Obstructive Pulmonary Disease. NHS Ayrshire & Arran

31. Keeney, E. and Holland, S. (2012) Economic Evaluation of Telehealth as part of the management of Chronic Obstructive Pulmonary Disease (COPD). NHS Ayrshire & Arran

32. Hearty, M., Aitken, L. and Alexander, H. (n.d.) Rapid Improvement Study: Hypertension Monitoring in General Practice. NHS Lanarkshire & TEC (unpublished)

33. HMHM Evaluation Case Study NHS Ayrshire & Arran Florence Hypertension Monitoring June 2017 (unpublished)

34. McIlroy, A., and Hearty, M. (n.d.) Hypertension Case Study. NHS Lanarkshire (unpublished).

35. McCall, V., Hoyle, L., & Gunasinghe S (n.d.) Bringing together health, social care and housing services for older people: An evaluation of the 415 Hub and Cluster Innovation Project (unpublished Powerpoint presentation)

36. McGuire, K. (n.d.) Transformation through Technology Enabled Care (TEC) and Innovation Business Case/Sustainability Plan [Draft]. NHS Ayrshire & Arran (unpublished)

37. Lanarkshire Partnership (2016) Technology Enabled Care Storyboard (unpublished)

38. NHS Ayrshire & Arran (n.d.) Home & Mobile Health Monitoring in NHS Ayrshire & Arran (TEC Yr2) Recruitment Summary (unpublished)

39. NHS Ayrshire & Arran (n.d.) Emergency Admissions Analysis – COPD patients (unpublished)

40. NHS Ayrshire & Arran (n.d.) Case Study Mr B (unpublished)

41. NHS Ayrshire and Arran (n.d.) TEC Technology Enabled Care Patient Stories. (unpublished).

42. NHS Ayrshire and Arran (n.d.) HMHM Avoided Admissions Cost Avoidance Analysis (unpublished)

43. NHS Ayrshire and Arran (n.d.) Evaluation Snap-shot Analysis June 2017 Home & Mobile Health Monitoring (COPD) in NHS Ayrshire & Arran (TEC Yr2) (unpublished)

44. NHS Ayrshire and Arran (n.d.) Test of Change: Hypertension BP Monitoring using Florence in General Practice (unpublished)

45. NHS Scotland (2016) National Video Conferencing Service Quarterly Report, 1st April 2016 to Mid-May (Sample report) (unpublished)

46. TEC (2017) TEC Video Conferencing 2016/17 Workstream Review (unpublished)

47. TEC (2017) Video Consulting Rollout using Attend Anywhere Mid-Year Review, January – June 2017 (unpublished)

48. United4Health (2015) UNIversal solutions in Telemedicine Deployment for European HEALTH care: Document ID3.9 Assessment of Organisational Impact and costs of telehealth COPD.

49. United4Health (2015) UNIversal solutions in Telemedicine Deployment for European HEALTH care: Document ID3.9 Assessment of Organisational Impact and costs of telehealth CHF.

50. Urquhart, J. and Carr, D (2017) Annual Telecare Data Report for Scotland January – December 2016 (unpublished)

51. Use of video consultations in urban general practices: a GPs' and health administrators' perspective (unpublished)

52. Using VC in South Lanarkshire Care Homes (June 2017) (unpublished)

53. Wolters, M. (n.d.) Report 1: Statistical analysis of system log data [Draft report for Florence & Motiva evaluations]

54. Wolters, M. (2017) Initial Contribution Story for COPD, Heart Failure, and Asthma in NHS Highland (unpublished).

Secondary published sources

55. Glasgow, R.E., Phillips, S.M. and Sanchez, M.A., 2014. Implementation science approaches for integrating eHealth research into practice and policy. International journal of medical informatics, 83(7), pp.e1-e11.

56. Health and Sport Committee Technology and Innovation in Health and Social Care (2018). [online] Available at: https://sp-bpr-en-prod-cdnep.azureedge.net/published/HS/2018/2/1/Technology-and-innovation-in-health-and-social-care/HSS052018R01.pdf [Accessed 26 Mar. 2018].

57. Hudson, B., 2016. Scotland's TEC Development Programme One Year On: A Scoping Exercise, [accessed online, 28th February, 2018] http://www.ehealth.nhs.scot/wp-content/uploads/sites/7/2016/11/TEC-Year-1-Review.pdf

58. May, C., 2013. Towards a general theory of implementation. Implementation Science, 8(1), p.18.

59. Mayne, J., 2001. Addressing attribution through contribution analysis: using performance measures sensibly. The Canadian journal of program evaluation, 16(1), p.1.

60. Meyers, D.C.,Durlak, J.A., Wandersman, A. (2012) The Quality Implementation Framework: A Synthesis of Critical Steps in the Implementation Process, American Journal of Community Psychology; Macon Vol. 50, Iss. 3-4, (Dec 2012): 462-80.

61. Nicholls, J., Lawlor, E., Neitzert, E. and Goodspeed, T., 2009. A guide to social return on investment. London: Office of the Third Sector, The Cabinet Office.

62. Obstfelder, A., Engeseth, K.H. and Wynn, R., 2007. Characteristics of successfully implemented telemedical applications. Implementation Science, 2(1), p.25.

63. Ossebaard, H.C. and Van Gemert-Pijnen, L., 2016. eHealth and quality in health care: implementation time. International Journal for Quality in Health Care, 28(3), pp.415-419.

64. Pawson, R., 2006. Evidence-based policy: a realist perspective. Sage.

65. Powell, B.J., Waltz, T.J., Chinman, M.J., Damschroder, L.J., Smith, J.L., Matthieu, M.M., Proctor, E.K. and Kirchner, J.E., 2015. A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project. Implementation Science, 10(1), p.21.

66. Treasury, H.M.S., 2003. The green book: appraisal and evaluation in central government.

67. Steventon, A., Bardsley, M., Billings, J., Dixon, J., Doll, H., Hirani, S., Cartwright, M., Rixon, L., Knapp, M., Henderson, C. and Rogers, A., 2012. Effect of telehealth on use of secondary care and mortality: findings from the Whole System Demonstrator cluster randomised trial. Bmj, 344, p.e3874.

68. van den Wijngaart, L.S., Roukema, J., Boehmer, A.L., Brouwer, M.L., Hugen, C.A., Niers, L.E., Sprij, A.J., Rikkers-Mutsaerts, E.R., Rottier, B.L., Donders, A.R.T. and Verhaak, C.M., 2017. A virtual asthma clinic for children: fewer routine outpatient visits, same asthma control. European Respiratory Journal, 50(4), p.1700471.

69. Weiss, C.H., 2000. Which links in which theories shall we evaluate? New directions for evaluation, 2000(87), pp.35-45.

Appendix 1: Data review classification results

This section provides an overview of the data classification that was undertaken. These are divided into economic and non-economic reports.

Non-economic reports

A total of 95 documents were reviewed, of these 54 contained evaluation data. Eight duplicates were identified. See Table A1.1 for a summary of these.

Table A1.1: Number and type of documents submitted to JE for analysis within each workstream

	HMHM	VC	Telecare	DP
Total number of documents containing evaluation data	28	7	13	7
Total number of documents containing background information	25	0	3	3
Duplicates	6	0	2	0
Total number of documents reviewed	59	7	18	10

Of the evaluations, half related to HMHM, 22% to Telecare and 13% each to DP and VC. See Figure A1.1 for a breakdown across the workstreams.

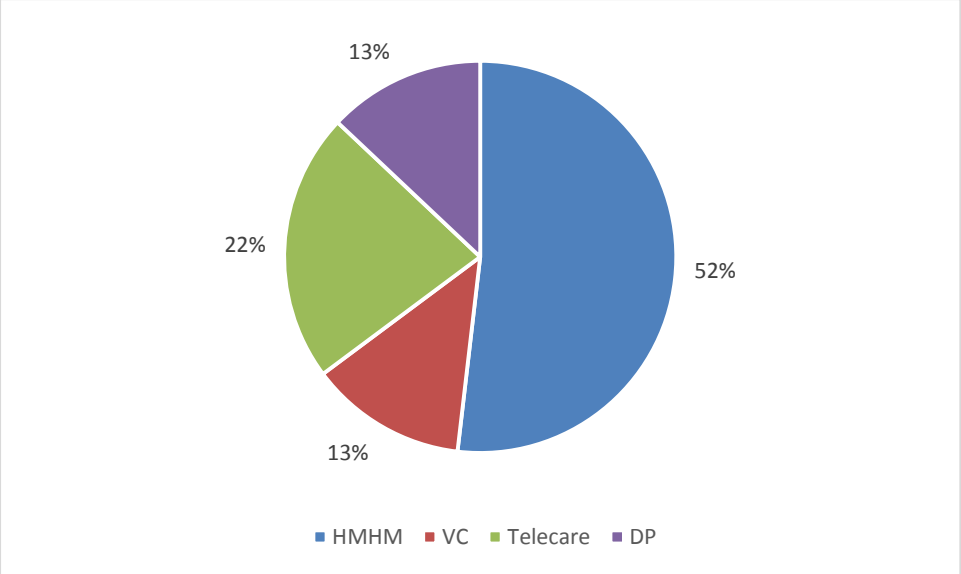

Figure A1.1: Reports containing evaluation data

After the initial classification, we began the analysis of each of the documents containing evaluation data. These were classified by the type of data they contained. Table A1.2 gives a breakdown of the data type by workstream. Note that mixed method reports were counted twice (i.e. containing both quantitative and qualitative data), hence the total number presented here is higher than the total number of reports included.

Table A1.2: Breakdown of qualitative and quantitative data by workstream

Data type	HMHM	VC	Telecare	DP	Total
Containing qualitative	12	4	3	7	25
Containing quantitative	21	5	11	2	39

Economic reports

A total of 10 reports containing economic or cost data were submitted to Just Economics for review across the four workstreams in September 2017 (see Table A1.3).[8] Reports that contained only project cost data, but no economic analysis of benefits were excluded from the review, as were forecasted cost-benefit analysis (see Box 1 for a discussion of the main findings of these).

Table A1.3: Number of economic documents with economic data submitted for analysis

	HMHM	TC	VC	DP	Total
Number of studies with economic data (excluding forecast studies)	4	4	2	1	10

Table A1.4 summarises the main features of the studies.

Table A1.4: Key features of the economic evaluations by workstream

	HMHM	TC	VC	DP	Total
Intervention cost data	4	4	2	1	10
Economic valuation of outcomes	4	4	2	1	10
Valuation of outcomes to multiple stakeholder	0	0	0	1	1
Discounting of benefits (if applicable)	0	3	0	1	3
Control group	4	2	1	1	7
Sensitivity analysis	3	3	0	1	6

[8] The analysis here represents a snapshot of the evidence available at the time of the review. Further work is currently underway, including a forthcoming analysis of the economic benefits of HMHM.

Appendix 2: Data review summaries by workstream

This Appendix contains the data review summary tables for each workstream.

Telecare

Table A2.1: Telecare quantitative data review summary

Number of reports	8
Area of LM covered	Outputs only (not outcomes) (2). Included outcomes (5)
Sample type	People with dementia (1), [remainder 'people in receipt of telecare' with no further information)]
Outcomes demonstrated (Number in [ ] refers to the numbered references in the bibliography)	Reduced avoidable/unplanned admissions to hospital [14] reduced number of delayed discharges [23], reduced care home admissions [14], avoided sleepovers [23], avoided respite care [23]. [One incidence of increased bed days following installation of telecare, but this may have been because telecare was installed following a hospital stay. When compared with matched controls this group showed no significant change in bed days]. Cost savings at national level
Geographical area	Falkirk (1) Renfrewshire (1), remainder unclear or national

Table A2.2: Telecare qualitative data review summary

Number of reports	3
Area of LM covered	Activities (3), outcomes (3)
Sample type	People with dementia (1), Carers (1), [remainder 'people in receipt of telecare' with no further information)]
Outcomes	Range of outcomes for service users, including increased independence [14, 23], reduced stress and/or anxiety [14,

demonstrated	23], and being able to stay in own home for longer [14, 23]. Significant benefits also reported for families and carers [11], including being able to care for their family member for longer, reduced stress and/or anxiety, being able to maintain some paid work and having respite from caring responsibilities.
Geographical area	Renfrewshire (1), Scotland-wide (2)

Video Conferencing

Table A2.3: Video Conferencing quantitative data review summary

Number of reports	5
Area of LM covered	Outputs only (not outcomes) (2) Includes outcomes (3)
Sample type	Older clients in receipt of psychiatric care, stroke patients, care home residents
Outcomes demonstrated	Better pharmaceutical management [8], improved access [8], reduced hospital admissions [8], and reduced length of stay [4]. Cost, time and travel savings were also reported by both clinicians and clients [47]
Geographical area	11 of 14 health boards (3), Highlands (1), Western Isles (1)

Table A2.4: Video Conferencing qualitative data review summary

Number of reports	4
Area of LM covered	Activities (3) Outputs (3) Outcomes (3)
Sample type	Stroke patients, care home residents, recipients of psychiatric care in care homes, urban GPs and related staff
Outcomes	Increased confidence of staff, family members and

demonstrated	patients in the quality of care [4, 8]; increased frequency of specialist input [4, 8]; improved care provision for stroke patients [4].
Geographical area	Highlands (1), Western Isles (1), South Lanarkshire (1), Lothian (1)

Digital platforms

Table A2.5: Digital platforms quantitative data review summary

Number of reports	1
Area of LM covered	Includes outcomes (1)
Sample type	Clients aged 50+, with long term health condition (COPD, diabetes, arthritis etc.), and their carers
Outcomes demonstrated	Increased self-management, improved social cohesion, and increased self-care in carers [10]
Geographical area	Forth Valley, Highland, Argyll and Bute, Lothian, Moray, and the Western Isles

Table A2.6: Digital platforms qualitative data review summary

Number of reports	6
Area of LM covered	Activities (4); Outcomes (3)
Sample type	Clients with long term health condition (COPD, diabetes, arthritis etc.), and their carers; hospice clients.
Outcomes demonstrated	Increased connectedness and reduced social isolation [10]; increased self-management [10, 16]; improved health outcomes [10, 16]; increased health and self-care knowledge [10, 16]; increase in client sense of

	responsibility [10, 16].
Geographical area	Forth Valley, Highland, Argyll and Bute, Lothian, Moray, the Western Isles, Ayrshire, Arran and Clyde Valley; Scotland-wide.

HMHM

Table A2.7: HMHM quantitative data review summary

Number of reports	11 (plus two contribution stories which may duplicate some findings)
Area of LM covered	Outcomes (10)
Sample type	COPD, diabetes, Chronic Heart Failure, hypertension, asthma, BP
Outcomes demonstrated	Increased awareness of self-management [1], small increase in condition control [1, 21, 30], reduced blood sugar levels in diabetes patients [19], increased clinical team skill in responding to HMHM data [32], clinicians adopting alerts to inform decision making [32], improved access to services [19], avoided hospital admissions [20, 30, 39], optimised face-to-face contacts [1]. Plus, some evidence of longer-term outcomes (people look after their own health and well-being, people have positive experiences of services. [32, 1, 21]
Geographical area	Arran and Ayrshire (4), Lanarkshire (1), Scotland-wide or not specified (5)

Table A2.8: HMHM qualitative data review summary

Number of reports	11
Area of LM covered	Activities (5) Outcomes (11)
Sample type	Primarily focused on patients receiving HMHM due to diabetes, COPD, CHF, asthma; BP, staff delivering

	HMHM; health care staff
Outcomes demonstrated	Feeling of connectedness and reassurance for patients [17, 28, 41, 54]; more responsive care [17, 49, 54]; improved health outcomes [1, 17, 29, 49]; some evidence of increased motivation to self-manage condition [1, 13, 17, 28, 41, 49]; convenience of undertaking monitoring at home [17, 29]; in some cases, reduced health visits/hospital admissions [17, 29].
Geographical area	Scotland-wide; Ayrshire and Arran; Lanarkshire;

Appendix 3: Measurement matrices

The following tables present measurement matrices for three of the workstreams. These compare the outcomes from the logic models with the evidence base and provide a qualitative assessment of confidence in the finding[9]. They have been derived from the initial spreadsheets developed in the data synthesis phase and combined with the outcomes identified in the logic models.

Table A3.1: Telecare measurement matrix

Outputs	Data	Short-term outcomes	Data	Type	Confidence	Medium-term outcomes	Data	Type	Confidence	Long-term outcomes	Data	Type	Confidence
No of service users with dementia etc.	Yes	**Increased feelings of independence and privacy**	Yes	Qual	High	**SUs remain in own home longer**	Yes	Qual	Medium	**Improved quality of life and wellbeing of SU**	Yes	Qual	High
No using TC alarms	Yes	**Increased confidence to stay at home**	Yes	Qual	High	**Fewer complication from falls, fires etc.**	No			**TC is given first consideration at point of referral**	No		
No and type of responses	Yes	**Increased number of genuine choices**	Limited	Qual	Medium	**Reduction in avoidable admissions**	Yes	Mixed	Medium	**Critical mass to achieve economic savings**	Limited	Quant	Medium
Improved perception of TC by profs	No	**Better community options for discharged patients**	Limited	Qual	Medium	**Reduction in delayed discharge**	Yes	Quant	Medium	**Fewer people experience regional disparities/health inequalities**	No		
Reports analyses on	Limited	**Fewer falls, accidents and**	Yes	Quant	Medium	**Reduction in overnight**	Yes	Mixed	High	**Improved person-centred effective**	Yes	Qual	Medium

[9] This was based on the author's assessment of how the strength of the evidence. For example, an outcome that was covered in several studies using a mix of methods in different geographies with good sample sizes would be considered to have a high confidence in the finding.

standardisation		**fires**				**care**				**healthcare**			
Analogue to digital SUs transferred	No	**Increased safety of SUs (earlier intervention in emergency)**	Limited	Mixed	Low	**Better targeting of resources to those who need it**	No			**There are no negative consequence from digital switchover**	No		
		Better understanding of good practice	No			**Greater consistency of provision**	No			**Improved health and well-being of carers**	Yes	Qual	High
		Carers feel more confident in caring role	Yes	Qual	High	**Reduced care burden on carers**	Yes	Qual	High				

Table A3.2: HMHM measurement matrix

Outputs	Data	Short-term outcomes	Data	Type	Confid-ence	Medium-term outcomes	Data	Type	Confid-ence	Long-term outcomes	Data	Type	Confid-ence
No of patients initiating HMHM	Yes	**Confidence and knowledge of self-management**	Yes	Mixed	Medium	**Improvement in condition control**	Yes	Mixed	Medium	**Critical mass to improve population health**	No		
Reduced number of FtF contacts	Limited	**Small proportion self-managing**	Yes	Mixed	Medium	**Larger proportion self-managing care**	Limited	Mixed	Medium	**Improved productivity and economic savings**	No		
No with LTC experiencing health inequalities	Limited	**Improved adherence to treatment**	Yes	Mixed	Medium	**Optimised FtF contacts and more timely appts**	Yes	Mixed	Medium	**Critical mass achieved to reduce burden of certain conditions**	No		
Increase in clinical team skill	Limited	**Improved outcomes for LTC**	Limited	Mixed	Medium	**Increased health and well-being of**	Yes	Mixed	Medium	**Increased likelihood that people with LTCs can live longer**	No		

		experiencing health inequalities				**patients**				**in own homes**			
Evidence reports	Yes	**Small % of clinician population adopting alerts**	Limited	Quant	Medium	**HMHM becomes the default for certain conditions**	No			**Improved person-centred effective healthcare**	Yes	Qual	Medium
		Small number of avoided delayed discharge	No			**Larger number of earlier discharge**	No			**Improved viability of remote and rural communities**	Limited	Qual	Low
		Small number of reduced wait times	No			**Larger number of reduced wait times**	No			**Improved recruitment, retention and well-being of clinical staff**	No		
		Carers feel more supported	Limited	Qual	Medium	**Larger number of avoided admissions**	No			**improved well-being of carers**	Yes	Qual	Low
						Carer has improved confidence	Limited	Qual	Low				
						Carer feels less burdened/ isolated	Limited	Qual	Low				

Table A3.3: VC measurement matrix

Outputs	Data	Short-term outcomes	Data	Type	Confidence	Medium-term outcomes	Data	Type	Confidence	Long-term outcomes	Data	Type	Confidence
No of AA waiting areas	Yes	**Improved access to specialist services**	Yes	Qual	High	**Improved quality of life and well-being of patients**	Limited	Qual	Medium	**Critical mass to improve population health**	No		
No of consultations	Yes	**Improved management of certain conditions**	Yes	Mixed	High	**Reduced risk of spread of infections**	No			**Improved well-being of carers**	No		
No of VC meetings	Yes	**Number of FtF meetings displaced/reduced need for travel**	Yes	Mixed	Medium	**Reduced need for carers to attend FtF app.**	No			**Critical mass to achieve economic savings**	No		
No of new connections between orgs/systems	No	**New ways of working e.g. access second opinion**	Yes	Qual	High	**Shorter waiting times for appts.**	Yes	Qual	High	**Reduced CO2 emissions**	No		
VC enabled programmes integrated	No	**Improved communication across health/care/SG**	Yes	Qual	High	**Better stability of vulnerable services**	Limited	Quant	Low	**Improved person-centred effective healthcare**	Yes	Qual	Medium
No of new service start-ups	Limited	**Improved collaboration between professionals**	Yes	Qual	High	**More skilled workforce**	Yes	Qual	Medium	**Improved viability of remote and rural communities**	Yes	Qual	Medium
Local evaluations	Yes	**Reduced travel/increased productivity staff**	Yes	Mixed	Medium	**Improved interoperability and efficiency**	Limited	Qual	Medium	**Improved health and well-being of professionals**	Yes	Qual	Medium

Appendix 4: Implementation workshop findings

Table A4.1: Barriers and solutions from workshop with delivery staff

Barriers	How they manifest	Possible solutions	How can I respond	What support do I need?
Competing workloads	Time constraints/priorities Not my role/responsibility Never done it before/why change? No time, unable to contribute, totally focused on 'day job'	Inspiring managers Leadership styles Realistic timescales Dedicated teams Allow to make mistakes -what is not worthwhile, walk away Buying in short-term support to allow staff training/development/up-skilling	Sharing knowledge locally Time for background work Keep chipping away Keep reinforcing with new management teams	Management buy-in Experiential training IJB or make it a local priority
Staff resistance	Concern over job security Time required to gain new expertise Perceptions re the technology 'testing phase' Tech not working – wasted time Clinician resistance due of lack of evidence Unclear pathways to put systems in place Time constraints Delays in installation put people off Lack of knowledge/confidence in equipment Lack of referrals	Address fear directly in training Effective upfront training How we engage it is not a pilot – it is tried and tested Use tech that we know works Information leaflets Reduce costs by encouraging service users to buy own solutions	Effective training feedback loops tailored Communicate effectively Use test of change vs testing technology Use service improvement methodologies Clarify pathways Improve training and information	Time and funding to develop tailored training. Ops major buy-in to release staff for training SOP development implementation user training and feedback Leadership for counteracting resistance. Extra staff time and money
Lack of SMT engagement	Lack of attendance at meetings Limited response to written communication Lack of understanding of initiatives	Make it an organisational priority Effective delegation Desktop guides for senior staff		

	Lack of support and positive action			
Service user resistance	Concern over reduction/removal of physical support Getting the messaging right Ensuring the value proposition is clearly articulated Generational issues and willingness to engage Cost (e.g.telecare)	More involvement in co-design Adequate staff training and awareness Clear messaging	Leadership Engagement	Community engagement Not a talking shop but structured Discovery and development with a group
Pace of implementation	Unable to deploy kit Poor facilities management	Delegated authority for quick/low spends outside of framework	Highlight as a risk to raise priority and manage expectations	Use as an example to IJB to get their 'push'
Issues with data/evidence	No linkages between systems Lack of data/inaccuracies because systems are not fit for purpose for data gathering Time taken to gather data too long	Centralised system	Try to ensure that the data we collect is as accurate as possible	Scottish government level push for national solutions
Funding and investment	Division between tests of change and business as usual monies Business case beyond pilots Period of sustained short-term funding. TEC also short-term but smaller and more focused	Generate an innovation centre approach to development. Test change scaling and combining projects nationally	Continue to support and actively contribute to TEC programme events Improve business case developments	Strategic and policy support

Table A4.2: Enablers and solutions from workshop with delivery staff

Enablers	How did they help?	Impact of support	How can I respond?	What further support do I need?
Recruiting the	Development of skills to communicate	Learning on the job	Make posts sustainable	Funding to mainstream

right staff	Able to adapt to changing circumstances			
Bringing in specialist skills	Identify gaps in in-house skills Assessment made easier; Tailor made package of care	Acknowledged need for outside skills Ensured that SUs got a service appropriate for their level of ability and understanding Improved QoL for SUs and supported them to live independently	Evidence required to obtain funding Get right people on board and encourage others to do this	Confidence to know when skills are needed Streamline accessibility to specialist support
Peer support/ access to practice help	Enabled effective communication of ideas/solutions with services affected	Secured engagement with service providers and helped to launch successful services	Agree minimum requirements for any new service delivery and implementation	Min engagement required Data analysis and ongoing evaluation Feedback to service providers (e.g. learning notes)
TEC programme team	Excellent guidance, not reinventing wheel, Learning from others Continual personal support/reminders	Feel valued Know that help is there Encourages good practice and organisation in your role	Be honest and ask for support Be open-minded as to what is working elsewhere Be willing to share and promote	Maintaining existing calls and support arrangements
Funding	Allowed dedicated time and staff resource Don't have to compete for funding with local departments	Enabled project to go ahead Helped citizens to benefit	Build business case to show benefits and convince of need for longer term investment	More funding

Appendix 5: Table of implementation strategies

Table A5.1: Table of implementation strategies

	Strategy types	Detail	Description	Who owns it?	Is it being done?
1	Incentives	Incentive structure	Work to incentivize the adoption and implementation of the clinical innovation		
		Mandate change	Have leadership declare the priority of the innovation and their determination to have it implemented		
		Disincentive structure	Provide financial disincentives for failure to implement or use the clinical innovations		
2	Local context	Assess readiness	Assess various aspects of an organization to determine its degree of readiness to implement, barriers that may impede implementation, and strengths that can be used in the implementation effort		
		Tailor strategies	Tailor the implementation strategies to address barriers and leverage facilitators that were identified through earlier data collection		
		Local needs assessment	Collect and analyse data related to the need for the innovation		
3	Measurement	Audit and feedback	Collect and summarize clinical performance data over a specified time period and give it to clinicians and administrators to monitor, evaluate, and modify provider behavior		
		Change records system	Change records systems to allow better assessment of implementation or clinical outcomes		
		Facilitate relay of clinical data to providers	Provide as close to real-time data as possible about key measures of process/outcomes using integrated modes/channels of communication in a way that promotes use of the targeted innovation		
		Academic partnerships	Partner with a university or academic unit for the purposes of shared training and bringing research skills to an implementation project		
		Purposely reexamine the implementation	Monitor progress and adjust clinical practices and implementation strategies to continuously improve the quality of care		
		Tools for quality monitoring	Develop, test, and introduce into quality-monitoring systems the right input—the appropriate language, protocols, algorithms, standards, and measures (of processes, patient/consumer outcomes, and implementation outcomes) that are		

			often specific to the innovation being implemented		
4	Information/sharing/best practice	Educational meetings	Hold meetings targeted toward different stakeholder groups (e.g., providers, administrators, other organizational stakeholders, and community, patient/consumer, and family stakeholders) to teach them about the clinical innovation		
		Educational materials	Develop and distribute educational materials		
		Capture and share local knowledge	Capture local knowledge from implementation sites on how implementers and clinicians made something work in their setting and then share it with other sites		
		Educational outreach	Have a trained person meet with providers in their practice settings to educate providers about the clinical innovation with the intent of changing the provider's practice		
		Create a learning collaborative	Facilitate the formation of groups of providers or provider organizations and foster a collaborative learning environment to improve implementation of the clinical innovation		
5	Partnership/coalition building	Build a coalition	Recruit and cultivate relationships with partners in the implementation effort		
		Obtain formal commitments	Obtain written commitments from key partners that state what they will do to implement the innovation		
		Develop resource sharing agreements	Develop partnerships with organizations that have resources needed to implement the innovation		
6	Technology	Have technical assistance	Develop and use a system - local, centralised or both - to deliver technical assistance focused on implementation issues		
		Change technology infrastructure and equipment	Evaluate current configurations and adapt, as needed, the infrastructure and/or equipment to best deliver the targeted innovation		
7	Piloting	Cyclical small tests of change	Implement changes in a cyclical fashion using small tests of change before taking changes system-wide. Tests of change benefit from systematic measurement, and results of the tests of change are studied for insights on how to do better. This process continues serially over time, and refinement is added with each cycle		
		Stage implementation scale up	Phase implementation efforts by starting with small pilots or demonstration projects and gradually move to a system wide rollout		
8	Training	Ongoing training	Plan for and conduct training in the clinical innovation in an ongoing way		
		Use train-the-trainer	Train designated clinicians or organizations to train others in the clinical innovation		

		strategies			
		Provide clinical supervision	Provide clinicians with ongoing supervision focusing on the innovation. Provide training for clinical supervisors who will supervise clinicians who provide the innovation		
		Shadow other experts and visit sites	Provide ways for key individuals to directly observe experienced people engage with or use the targeted practice change/innovation		
		Work with training colleges	Encourage educational institutions to train clinicians in the innovation		
		Make training dynamic	Vary the information delivery methods to cater to different learning styles and work contexts, and shape the training in the innovation to be interactive		
		Implementation glossary	Develop and distribute a list of terms describing the innovation, implementation, and stakeholders in the organizational change		
9	Templates/manuals	Blueprint	Develop a formal implementation blueprint that includes all goals and strategies.		
10	Funding	Fund and contract for the clinical innovation	Governments and other payers of services issue requests for proposals to deliver the innovation, use contracting processes to motivate providers to deliver the clinical innovation, and develop new funding formulas that make it more likely that providers will deliver the innovation		
11	Champions	Identify and prepare champions	Identify and prepare individuals who dedicate themselves to supporting, marketing, and driving through an implementation, overcoming indifference or resistance that the intervention may provoke in an organization		
		Involve patients/consumers and family members	Engage or include patients/consumers and families in the implementation effort. Develop strategies with patients to encourage and problem solve around adherence		
		Obtain and use patients/consumers and family feedback	Develop strategies to increase patient/consumer and family feedback on the implementation effort		
12	Stakeholder engagement	Prepare patients/consumers to be active participants	Prepare patients/consumers to be active in their care, to ask questions, and specifically to inquire about care guidelines, the evidence behind clinical decisions, or about available evidence-supported treatments		
		Organize clinician implementation team meetings	Develop and support teams of clinicians who are implementing the innovation and give them protected time to reflect on the implementation effort, share lessons learned, and support one another's learning		
		Promote adaptability	Identify the ways a clinical innovation can be tailored to meet local needs and clarify which elements of the innovation must be maintained to preserve fidelity		
13	Leadership	Provide clinical supervision	Provide clinicians with ongoing supervision focusing on the innovation. Provide training for clinical supervisors who will supervise clinicians who provide the		

			innovation		
		Provide ongoing consultation	Provide ongoing consultation with one or more experts in the strategies used to support implementing the innovation		
		Recruit, designate, and train for leadership	Recruit, designate, and train leaders for the change effort		
14	Promotion	Use mass media	Use media to reach large numbers of people to spread the word about the clinical innovation		
		Inform local opinion leaders	Inform providers identified by colleagues as opinion leaders or “educationally influential” about the clinical innovation in the hopes that they will influence colleagues to adopt it		
		Start a dissemination organization	Identify or start a separate organization that is responsible for disseminating the clinical innovation. It could be a for-profit or non-profit organization		
		Remind clinicians	Develop reminder systems designed to help clinicians to recall information and/or prompt them to use the clinical innovation		
15	Specialist skills	Use an implementation advisor	Seek guidance from experts in implementation		
		Use a data expert	Involve, hire, and/or consult experts to inform management on the use of data generated by implementation efforts		
		Use advisory boards and workgroups	Create and engage a formal group of multiple kinds of stakeholders to provide input and advice on implementation efforts and to elicit recommendations for improvements		

How to access background or source data

- cannot be made available by Scottish Government for further analysis as Scottish Government is not the data controller.

social research

The views expressed in this report are those of the researcher and do not necessarily represent those of the Scottish Government or Scottish Ministers.

This document is also available from our website at www.gov.scot.
ISBN: 978-1-78851-898-7

The Scottish Government
St Andrew's House
Edinburgh
EH1 3DG

Produced for
the Scottish Government
by APS Group Scotland
PPDAS415406 (05/18)
Published by
the Scottish Government,
May 2018

GSR
GOVERNMENT SOCIAL RESEARCH
Social Science in Government

Social Research series
ISSN 2045-6964
ISBN 978-1-78851-898-7

Web and Print Publication
www.gov.scot/socialresearch

PPDAS415406 (05/18)