Towards Scaling Up Home and Mobile Health Monitoring 2015-2018

An evaluation of the outcomes achieved by Year 3 and progress towards scale-up, spread and sustainability

Dr Helen Alexander

ACKNOWLEDGEMENTS

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AT A GLANCE
– YEAR 3 HMHM EVALUATION

15,765 people used Home and Mobile Health Monitoring (HMHM) (also known as remote digital monitoring or telehealth) between May 2015 and June 2018.

Majority of partners started from a **low base** or were **new to the use and adoption** of HMHM within local services.

The people using HMHM were hugely positive about it, reporting positive health care experiences

"It provided much-needed support"

"It really reassured me"

"You're made to feel like they're actually there, looking after you"

"I liked being able to monitor without taking up the nurse's time"

There has been significant growth in the adoption and integrated use of HMHM

The three year HMHM programme aimed to move from small scale pilots to large scale deployments informing scale-up and spread. Much was expected of HMHM, and the partners have made considerable progress with three years of funding:

Uptake rose steadily over time from **2,809** (Year 1) to **7,636** (Year2) and **15,765** (Year 3).

Uptake in Year 3 was more than double what it took the first two years to achieve.

The top conditions/populations covered by HMHM were **hypertension**, **mental health**, **respiratory** & **heart disease**, and **diabetes**.

There is good evidence of NHS resources being used **more effectively** and **efficiently** and hospital admissions avoided through use of HMHM.

This national evaluation presents robust evidence that, when supported by HMHM:

More people self-manage their health and care

Condition-control improves

Face to face contacts (appointments) are optimised

Access to services increases

National HMHM Programme has provided a firm foundation for future developments and much has been learned which offers important insights into how scale up efforts can best be accelerated.

The programme has remained pragmatic and realistic about the how long it might take to move towards scale up and achieve sustainability.

This evaluation identified key features that would enable future scale up efforts to support implementing HMHM within a complex, dynamic health and care system.

Further scale up of HMHM is required to reach population level gain. It is suggested that Scotland would benefit from setting a target level of HMHM scale-up within national policy that could lever the kind of radical change needed to impact on our health.

The inherent level of complexity with HMHM, and the results of this evaluation have shown that the benefits at a population level cannot be realised quickly. Success would be increased if some of the complexity (e.g. infrastructure, organisation, workforce) was reduced.

FOREWORD

I am delighted to share our National Home and Mobile Health Monitoring (HMHM) Evaluation with you. This report provides a comprehensive overview of the contribution and outcomes of the Home and Mobile Health Monitoring Programme a key delivery priority of the Technology Enabled Care (TEC) Programme and the new Digital Health and Care Strategy.

This report draws on evidence and valuable experience from across the TEC Funded partners in Scotland and at national level. The report sets out recommendations as to how we can shape and inform our future national HMHM activities to support our scaling up efforts over the next few years to achieve wider population health benefits and support at scale service transformation.

This is a crucial programme of work and has established important foundations and seen an acceleration in the number of people in Scotland who are now able to access and benefit from use of Home and Mobile Health Monitoring . Some HMHM approaches have now moved into delivery at scale. This nationally driven programme has enabled learning of what works well to be shared and champions " once for Scotland" approaches. It is supporting local organisations to develop enhanced capacity for digital health and care service transformation.

Given the pace of change in technology, and the explosion of digital opportunities there is plenty more to do if we are to meet our citizen expectations and support the necessary transformation in our public services.

My thanks to all the TEC Funded partners provided evidence for this report , Dr Helen Alexander and the National Evaluation Steering Group who overseen and guided the evaluation programme.
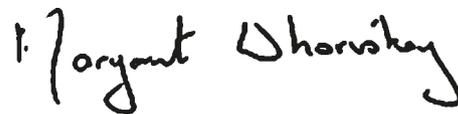
Margaret Whoriskey
Head of Technology Enabled Care and Digital Health innovation

1 INTRODUCTION AND BACKGROUND

1.1 TECHNOLOGY ENABLED CARE IN SCOTLAND

1.1.1 THE EVOLVING STRATEGIC CONTEXT

Technology Enabled Care (TEC) has increasingly been gaining attention in recent years. When the TEC fund was launched in 2014, the focus was specifically on embedding and expanding the application of technology, because its potential was not widely understood at that time. Home health monitoring was one of the five priority areas identified for investment, with the aim of moving beyond small to medium scale initiatives to create substantial transformational programmes across Scotland. Involvement with the European programme, United4Health (Rasmussen, 2016) provided valuable experience of how to enable TEC scale up and considerable learning that could be applied beyond long term conditions. The intention was for TEC to progress from being an adjunct to care to become a core part of health and care delivery. This would require identifying which conditions and citizens could benefit most and which services should be scaled-up beyond the three years of funding available. Sustainability was not expected to be achieved within this timescale, but areas that merited further investment would be identified. Scotland was on a journey to support scale-up and spread, and home health monitoring was a priority.

Progress in the intervening years is captured eloquently in three seminal 2018 publications, which also set a clear strategic vision to ensure that Scottish citizens will benefit from TEC's full potential. The first of these is our Parliament's Health and Sport Committee report from its inquiry into *Technology and Innovation in Health and Social Care* (Scottish Parliament, 2018). In their conclusions they noted that the health and social care sector was culturally reluctant to adapt to new ways of working, there were multiple incompatible systems/platforms in use, and the uptake of technology was slow and inconsistent. However, the Home and Mobile Health Monitoring workstream was commended as an exemplar that others could learn from. In addition, this report's authors looked to the imminent *Digital Health and Care Strategy* to radically develop the use of technology in health and social care.

The *Digital Health and Care Strategy* (Scottish Government, 2018a), along with the *Report of the External Expert Panel* (Scottish Government, 2018b) that informed it, has an ambitious vision to improve outcomes, based on the 'world leading' nature of our TEC programme. The vision would be realised by empowering citizens 'to better manage their health and wellbeing, support independent living and gain access to services through digital means' and by scaling the use of technologies, putting in place 'the underpinning architectural and information governance building blocks for the effective flow of information across the whole care system'. There was also a reaffirmation of the Christie Commission (Public Services Commission, 2011) suggestion that 'radical change in the design and delivery of public services [was] necessary' and that this needed 'to be driven by how best services can achieve positive outcomes'. The new strategy noted how critical it was for spread and adoption at scale of proven digital technologies, including the need for scale-up of home and mobile health monitoring (HMHM), the development of digital skills across the workforce, and creation of a national digital platform.

1.1.2   WHAT IS HOME AND MOBILE HEALTH MONITORING (HMHM)?

Home and Mobile Health Monitoring (HMHM) is one of the TEC programme's five workstreams. In addition to setting out the clear case for HMHM adoption due to the increasing number of people with long-term conditions, our National Service Model for HMHM (Scottish Government, 2017) says:

'Home and mobile health monitoring (remote monitoring) describes those activities that enable patients outside of healthcare settings to acquire, record and relay clinically relevant information about their current condition to an electronic storage system where it can be used to inform or guide self-management decisions by the patient and/or to support diagnosis, treatment and care decisions by professionals'

HMHM was the term agreed to describe this activity within the TEC programme, but increasingly different terms are often used interchangeably in the literature. Vegesna et al (2017), in a systematic review seeking to identify key trends, highlighted the inconsistent terminology currently in use and proposed the term 'Remote Patient
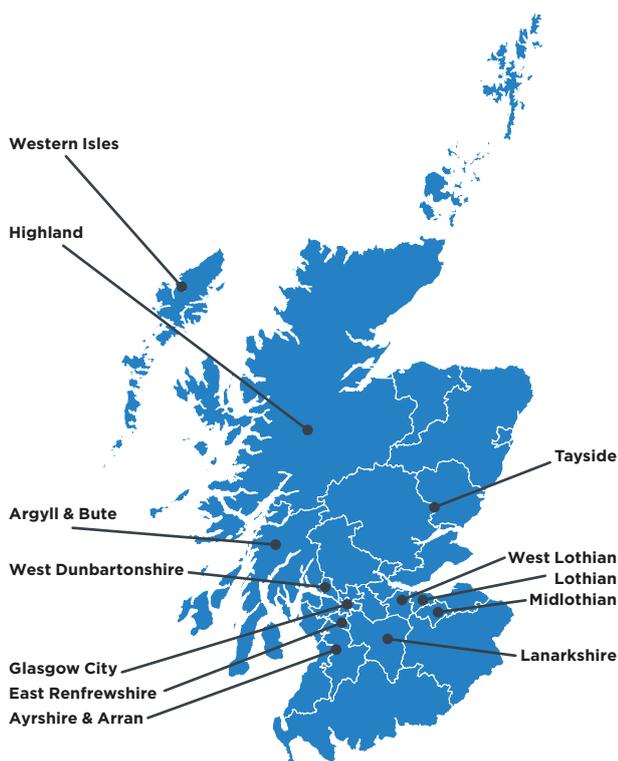
Monitoring' (RPM). Terms such as RPM or RMT (Remote Measurement Technology) are being used more frequently (e.g. Simblett et al, 2018). More recently HMHM is described as 'Remote Digital Monitoring', or simply 'Remote Monitoring'.

1.1.3   SCOTLAND'S HMHM PROGRAMME

A diverse group of 12 partners was successful in securing awards from HMHM Programme funding. They were a mix of NHS Boards and Health & Social Care Partnerships, including the seven building on initial successes or altering course after Year 1 and the five who came on board during Year 2. Some partners were able to recruit HMHM users at an early stage while others took a long time to overcome the obstacles they encountered. These differences and geographic considerations (Figure 1) are amongst the characteristics that most affected progress and therefore ability to scale-up, even with the considerable initial enthusiasm within each partnership.

HMHM activity was supported in a number of ways, including a dedicated national team, and a learning collaborative to enable experiences to be shared and problems explored. The partners themselves were very committed, particularly those who had more experience to share.

The implementation approach invited partners to determine locally what population groups would be offered HMHM and identify through user engagement which technologies would be adopted. This opened up the use of HMHM to a diverse range of services. The most popular HMHM services were hypertension, mental health, health improvement, Chronic Obstructive Pulmonary Disease (COPD) and heart failure, although many other protocols were developed. The term 'condition' is used to cover the full range, although it is acknowledged that this is not an entirely accurate descriptor. The most frequently deployed HMHM technology was Short Message Service (SMS) (used by 11 partnerships), although home pods, web platforms and telephone keypads were also used.

Figure 1 – The 12 HMHM partners

1.2 EVALUATING HMHM IMPLEMENTATION

This evaluation builds on the experience of participating in the United for Health programme (Rasmussen, 2016), the scoping exercise undertaken after Year 1 of the TEC Programme (Hudson, 2016), the outcomes achieved for HMHM by the end of its second year (Alexander, 2017), and the recent review of the Technology Enabled Care programme (Just Economics, 2018). Importantly, this latter report recognised that methods such as Randomised Controlled Trials (RCTs) may not be appropriate for evaluating TEC and acknowledged that HMHM had the most evaluation data available of all five workstreams. We have grasped the opportunity to explore another layer of HMHM evaluation within the context of the Just Economics programme level findings. Looking in more depth at the outcomes identified in the TEC review has enabled contributions towards their achievement to be identified. HMHM implementation is also sufficiently advanced to take evaluation to the next level and provide comment on progress with scale-up and spread and make some recommendations.

1.2.1 METHODOLOGIES EMPLOYED BY OTHERS TO LEARN ABOUT HMHM

Greenhalgh et al (2016) describe three generations of technology research to date, specifically for assisted living, but with wider relevance. First there was a focus on technical design to prove that the concept worked, second was experimentation (largely randomised controlled trials) and thirdly there were qualitative studies of patient experience. The authors recommend a fourth generation approach that is interdisciplinary, can absorb complexity, and recognises reciprocity, local needs/ ownership, and competing interests/power struggles. They argue for 'good-enough' technology solutions that can be 'co-created and sustained

through human effort in the messy and contingent reality of local health and social care services'. Greenhalgh et al recognise that this is the territory inhabited by implementation science, as employed in our national TEC programme review (Just Economics, 2018), but they contend that the learning has not yet been applied sufficiently widely or systematically. A recent review by Hanley et al (2018) demonstrated what could be learned about HMHM complexity across several qualitative studies.

An attempt has been made in this evaluation to adopt a 'fourth generation' approach, balancing local and national needs, working through competing interests and using Contribution Analysis to absorb some of the complexity. Reciprocity was agreed at the outset, with the local partners providing most of the evaluation data, and the whole premise in relation to the technology being deployed was that it should be 'good enough' for its purpose, sometimes for want of an ideal solution.

1.3 EXISTING EVIDENCE OF HMHM OUTCOME ACHIEVEMENT

In their mapping of outcomes across systematic reviews, Totten et al (2016) concluded that there was considerable evidence for positive outcomes, particularly for remote patient monitoring (RPM) of several chronic conditions. This is in keeping with other studies which demonstrate the benefits for hypertension management in Scotland (McKinstry et al, 2013) and internationally (Parati et al, 2018) and across the UK for diabetes control (Wild et al, 2016). However, the evidence for respiratory disease remains less clear, with some systematic reviews concluding that further research is still needed (e.g. Cruz et al, 2014).

1.4 HMHM SCALE-UP, SPREAD AND SUSTAINABILITY

Despite policy directives to focus on scale, Imison et al (2016) caution that focusing on the technology will not lead to radical change. They say that 'transformation comes from new ways of working, not the technology itself' so we need to look more widely to understand scale. There have been many publications on critical success factors for scaling up TEC, including one sharing expertise at European level (Momentum, 2014) and a bespoke review for the HMHM programme in Scotland (Milsom, 2015). The academic literature is also awash with systematic reviews on what needs to be done to ensure scale, but Greenhalgh et al (2017) point out that uptake is often low and explained by a rash of barriers and facilitators. They go on to say that 'it is not individual factors that make or break a technology implementation effort but the dynamic interaction between them. The more complex an innovation or the setting in which it is introduced, the less likely it is to be successfully adopted, scaled up, spread, and sustained'. They utilised a wealth of available literature and empirical data from technology implementation case studies to create a framework to evaluate scale, spread and sustainability. Greenhalgh et al (2017) define these terms as:

- Scale-up – moving from a local project to one that is 'business as usual'
- Spread – transfer to new settings
- Sustainability – being maintained long-term, adapting as required

1.4.1 HMHM IMPLEMENTATION EVALUATION IN SCOTLAND

Both the policy and academic fields have identified the need to focus on TEC scale-up and spread and the usefulness of a view on sustainability, so success for HMHM should also be considered in these terms. It is acknowledged that sustainability was not part of the aims of the HMHM Programme in Scotland, but it is possible that some of the evaluation learning can inform future arrangements. The detailed learning from HMHM Year 3 presented in this report comprises two main components:

Section 2. Evidence of 12 partners' contributions to key HMHM outcomes
Section 3. Consideration of HMHM scale-up, spread and sustainability

National work is also nearing completion on an economic evaluation of HMHM, with a focus on hypertension, mental health and respiratory disease. This will be published in a separate report. In the meantime, Peretz et al's 2016 systematic review provides some useful background on remote monitoring costs.

2 CONTRIBUTIONS TO HMHM OUTCOME ACHIEVEMENT

2.1 OUTCOMES TO BE ACHIEVED BY HMHM IN SCOTLAND

Recognising the policy directive to focus on outcomes, the Home & Mobile Health Monitoring (HMHM) workstream began to develop its logic model at an early stage. Although the aim was to map out what was to be achieved, the process of creating it was helpful for clarifying what was in and out of scope, and communicating this across all 12 partners. The agreed outcomes are shown in Figure 2.

Figure 2 sets out how it was envisaged that the HMHM workstream would link all the inputs and related activities to seven of the national health and wellbeing outcomes (not that the outcomes around carers and safety weren't relevant, just not so obviously influenced by the activities planned). The logic model made explicit the key outcomes to be achieved in Year 2 of the programme (shorter-term) and Year 3 (medium-term). They relate mainly to self- management, condition control, the effect on appointments/face to face contacts where these were needed, and access to services. The conversation then progressed to how the programme would demonstrate outcome achievement.

Figure 2 – Logic model for national HMHM 2016 to 2018
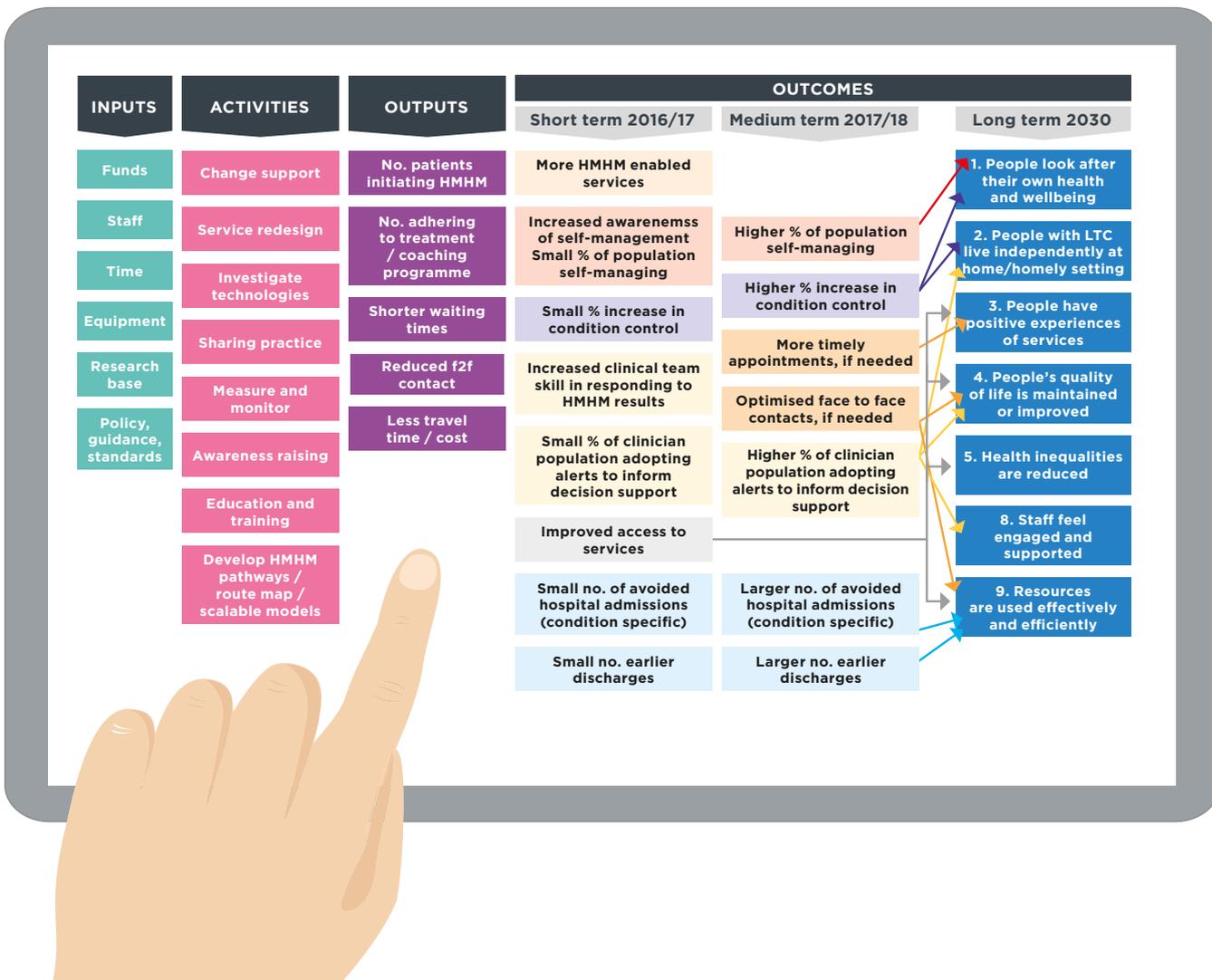
2.2 BRIEF OVERVIEW OF CONTRIBUTION ANALYSIS

In the real world it is rare for a single action to be solely responsible for causing an effect, since life is generally more complicated than that. The HMHM programme incorporates a variety of technologies, conditions and patients/service users across 12 partners with an inherent level of change, so its evaluation required a method that acknowledged this attribution problem. Contribution Analysis (CA) can encompass all of this complexity, gathering evidence to support an agreed theory of change (or logic model) that can be refined over time, thus generating credible claims that link a range of activities to observed results. There are six steps involved in CA (Mayne, 2012):

First	Describe what is being claimed about the link from inputs to observed results
Second	Make explicit the theory about how change will be achieved
Third	Gather evidence around the theory of change
Fourth	Assemble an initial contribution story
Fifth	Gather additional evidence, including alternative explanations for the results
Sixth	Revise / strengthen the credible contribution story

The first four CA steps were covered in the Year 2 evaluation report at Appendix B (Alexander, 2017):

1. We claimed that the HMHM programme would enable many more people to realise the range of benefits it offered

2. The logic model in Figure 2 represents the theory of how the HMHM inputs and activities were expected to lead to the short- & medium-term outcomes, and contribute to the national health and wellbeing outcomes

3. Evidence was gathered from all 12 HMHM partners in a stepwise process, firstly agreeing which of the logic model outcomes they would contribute to, then what evidence they could gather that would demonstrate this, and finally if they would like any assistance with their evidence. Once received, the quality of the evidence was rated and only that deemed to be a robust demonstration of outcome achievement used in step 4

4. The robust evidence was assembled into an initial contribution story which showed that the partners had contributed to Scotland having more HMHM enabled services. HMHM had also prompted an increased awareness of self-management and a small increase in condition control, in line with the key outcomes that had been envisaged for Year 2

The CA methodology assumed that all the HMHM partners were able to demonstrate their contribution to outcome achievement. Since no single activity was sufficient to claim full credit for outcome achievement, their contribution was only recognised if the evidence they had agreed to provide was deemed to be sufficiently robust i.e. it met generally accepted standards relevant to each type of evidence. Where evidence was not provided, it did not mean that outcomes were not being achieved, simply that there was no proof that they were.

This Year 3 evaluation report concentrates on CA steps 5 & 6 i.e. the additional evidence required around the theory of change, including alternative explanations for the results (step 5), and the evaluation and collation of the evidence into this stronger, more credible contribution story (step 6).

2.3 EVIDENCE OF OUTCOME ACHIEVEMENT

The outcomes that would be the focus of Year 3 evaluation activity were mainly those from the logic model expected to be achieved in the medium-term:

- Higher % of the population self-managing
- Higher % increase in condition control
- Optimised face to face contacts, if needed
- Improved access to services (this was originally short-term, but not fully evidenced in Year 2)

In addition, some partners were keen to provide evidence of how they were using resources effectively and efficiently or avoiding hospital admissions. Lastly, since increased uptake of new technology is dependent on usability , an overview of patient/service user experience was included.

2.3.1 EVIDENCE SELECTION

It should be noted that this report does not include all of the evidence submitted or available in relation to the HMHM outcomes. It would be considerably longer if it did, so in the interests of brevity, robust evidence was selected that covered a wide range methods across all the partnerships. Once a ceiling had been reached that appeared to demonstrate outcome achievement, no further evidence was added. In practice this meant that some of the partners who had developed and generously shared data gathering tools did not have the results they obtained using them included. In most cases, they had considerable amounts of alternative data to evidence their contributions. Additional HMHM evaluation data generated by different partners can be found in the reference section of this report e.g. Wolters (2017) and Mackenzie et al (2017). Publication of Lothian's external evaluation is imminent.

2.3.2 EVIDENCE TYPE

A deliberate attempt was made to generate a mix of numbers and words in relation to the HMHM outcomes. It was felt that this would give a richer overview of progress and where qualitative data is included it should not be viewed as less robust than quantitative alternatives. This is not the place to re-run debates around the supremacy of certain types of evidence, rather the strengths of both approaches were acknowledged at the outset of this work and partners encouraged to submit a variety of data.

2.3.3 EVIDENCE FROM DIFFERENT PARTNERS

Some partners were necessarily at a more mature stage of HMHM development than others, largely those who were awarded funding for the full three years (although for a few this related to various challenges they had faced). This meant that some areas were in a better position to submit a wider range and quantity of evidence. However all 12 partners were able to contribute to this evaluation and they should be applauded for building data gathering into their work plans.

This report is largely constructed from local data generated across Scotland, from both large and small partners. Where funding was awarded to partners covering fairly small populations, there was an expectation that their quantitative evidence would comprise limited numbers.

Some partners commissioned external evaluations, and these results have been included wherever relevant. Others generated evidence that was also used to support a Masters qualification, publicity/communication strategy, greater buy-in from their local population, or recognition at awards ceremonies or international symposia.

2.3.4 EVIDENCE FOR DIFFERENT CONDITIONS

There is a larger body of evidence related to some conditions than others, due to the number of partners including them in their portfolio and the service-level appetite for spread (see section 3). For example, remote blood pressure monitoring appears to be closest to tipping into normal service provision for the HMHM partners, whereas other protocols are still being developed. This report prioritised evidence for the top conditions affecting the Scottish population, namely respiratory and heart disease, diabetes and mental health, although some others were included where possible. The relevant condition is highlighted in the following tables of outcome contributions, although some results were not condition-specific, rather the partners forwarded some evidence across patient/service user or staff groups.

2.3.5 HMHM OUTCOME – A HIGHER % OF THE POPULATION SELF-MANAGING

Table 1 summarises the selected evidence that demonstrates contributions to this outcome from all the partners, relating to different conditions and developed using a range of methods.

Table 1 shows that all 12 partners made progress increasing the use of HMHM during Year 3. Lanarkshire has the biggest number, followed by Ayrshire & Arran, Highland and Lothian. Figure 3 puts these numbers into context, showing the considerable growth over the three years of HMHM. The rate of increase is also rising, with the total for Year 3 (8,129) being slightly more than it took the first two years to achieve (7,636).

Table 1 – Evidence submitted for 'Higher percentage of the population self-managing, supported by HMHM' (data to 31st May 2018, unless stated otherwise)

Outcome definition – People/patients actively doing something, not just submitting readings to Flo/pod

Partner	Measure	Data source	What the evidence shows
All 12 partners	No. using HMHM as a % of whole population	May 2018 Highlight Reports	**TOTAL USED HMHM at 30th June, 2018 = 15,765** Argyll + Bute **739**; Ayrshire + Arran **3,230**; East Renfrewshire **269**; Glasgow City **246**; Highland **2,377**; Lanarkshire **5,017**; Lothian **1,829**; Midlothian **73**; Tayside **278**; West Dunbartonshire **85**; Western Isles **921**; West Lothian **263**; *Renfrewshire **438****
Argyll & Bute	**Relaxation** – HMHM prompting self-management	Local patient survey	8 of 9 people said HMHM had increased their motivation to do relaxation exercises
		Case study	Person said, "Flo has encouraged me to do more for myself" and "all my stress and tension has gone"
Ayrshire & Arran	**COPD** – no. stepping down to less intensive HMHM support	Local data	105 people had stepped down from Homepod fully managed service to Flo, self-management
	Diabetes – no. self-managing insulin administration based on HMHM results	Local data	16 people have started the HMHM self-management protocol to support management of HbA1c

Partner	Measure	Data source	What the evidence shows
Highland	**Diabetes** – no. self-managing insulin administration based on HMHM results	Local data	3 people reported as self-adjusting insulin dose
		Local patients	With a "long-term condition it's easy to let things lapse. Flo is a good reminder and I need that", "Flo makes me do it"
		Case study	One person avoided starting insulin by improved diabetes management
	Intermittent claudication – no. reporting they walked more with HMHM support	Local patient survey	6 of 12 people said their walking ability had improved
	Health improvement – no. adhering to HMHM recommendations	Local data	420 people have adhered to recommendations across 10 health improvement protocols to support health and well being
Lanarkshire	**Mental health** – no. commencing on-line 'Beating the Blues' programme	NHS24	452/559 (81%) who opted to use Flo commenced the programme compared to 1120/2379 (47%) not supported by HMHM
	Health improvement – no. adhering to HMHM recommendations	Local data	398 people have adhered to recommendations across 3 health improvement protocols
Lothian	No. using HMHM as a % of population with hypertension in participating practices	External evaluation	12.3% of participating GP practices' hypertension population are self-managing supported by HMHM
Tayside	**Health improvement** – no. adhering to HMHM recommendations	Local data	7 mums-to-be are complying with smoking cessation protocol at 3 months, 46 complying with weight management protocol at 12 weeks
	Cystic Fibrosis – adhering to weight gain protocol, supported by HMHM	Case study	Protocol for boosting calorie intake provided a "system" to manage weight and "I now remember better to eat my snacks". Resultant weight increase led to removal of gastrostomy feeding tube
West Dunbarton-shire	**COPD** – no. managing condition supported by HMHM	Local patient survey	Of 12 providing feedback, all agreed Flo helped them manage their condition, 10 understood symptoms better, all were more confident to start rescue medication
Western Isles	**Diabetes** – no. self-managing insulin administration (via CGM) based on HMHM results	Local data	28 people are self-managing their insulin administration
		Case studies	Two people describe how they now have a greater knowledge of their diabetes management and the actions they take in response to HMHM results e.g. taking medication or altering their diet
West Lothian	**COPD** – cataract surgery refusal challenge, supported by HMHM	Case study	Frail patient with lung disease was refused cataract surgery but challenged the decision by saying was self-managing condition and needed to see inhalers
	Autism – medication self-management supported by HMHM	Case study	Flo prompted a 13 year old to take his medication regularly and he has now taken responsibility for this instead of relying on his parents. Taking medication at the right times has improved sleep patterns for the whole family

* Renfrewshire participated in Year 1, but did not continue into Years 2 & 3

Figure 3 – Cumulative total of HMHM users over time
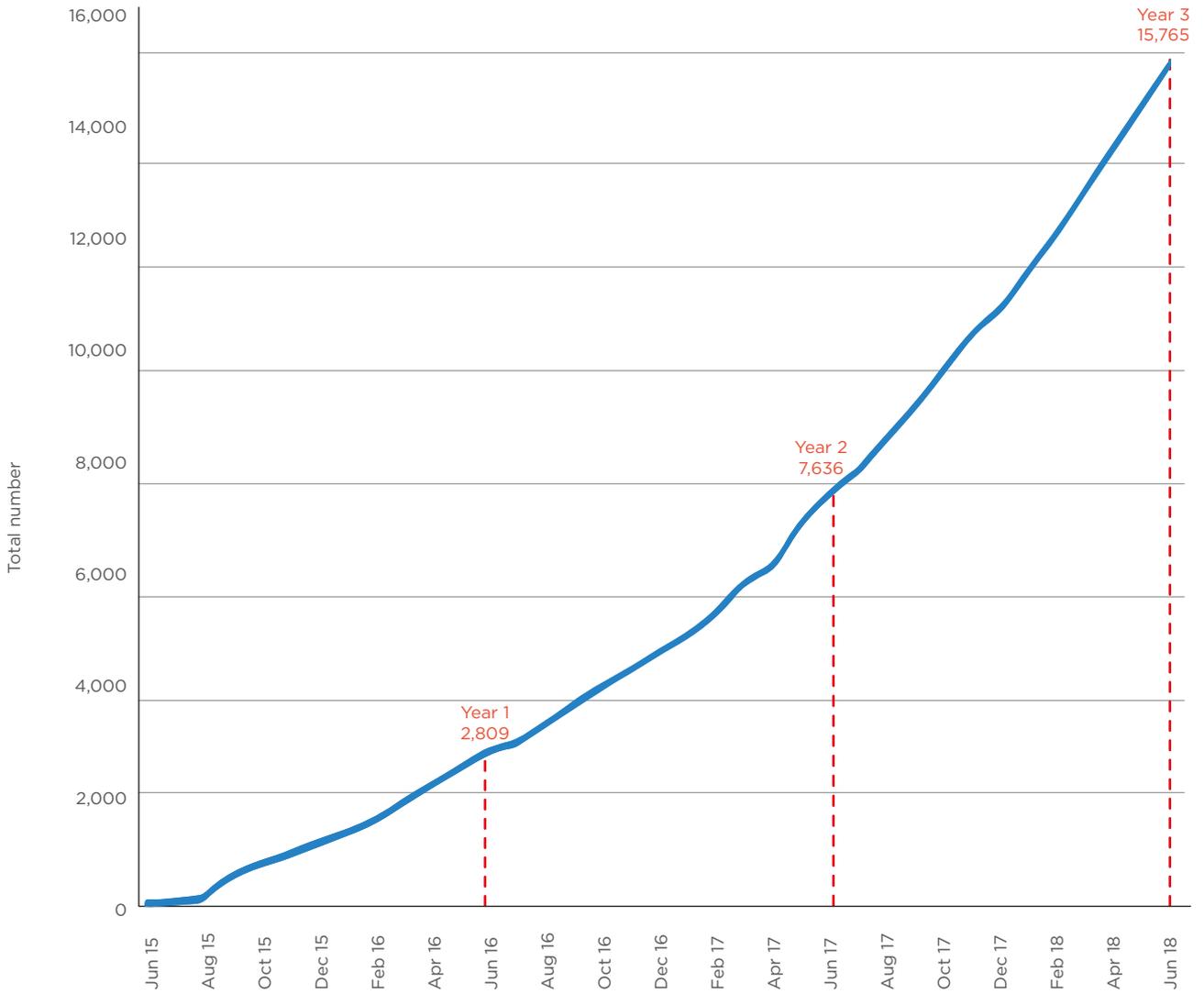
From this evaluation , there is robust evidence that people were actively doing something e.g. changing behaviour in response to HMHM, not just passively submitting readings. Despite only a sample of the evidence available being included here, these results provide strong evidence that the adoption of HMHM has contributed to increased self-management in targeted cohorts and populations accessing it.

2.3.6 HMHM OUTCOME – A HIGHER % INCREASE IN CONDITION CONTROL

Table 2 summarises the selected evidence that demonstrates contributions to increased condition control.

Evidence outlined in Table 2 illustrates that all 12 partners generated considerable robust evidence of the contribution of HMHM towards achieving this outcome. Condition control (treatment adherence) was mainly demonstrated by the maintenance or improvement in a relevant metric such as blood pressure, blood sugar, weight, or different symptoms. However, a number of partners submitted survey data across different conditions or feedback from local clinicians. Evidence of improved attendance at or adherence to programmes that peer reviewed literature had shown effected greater condition control e.g. for mental health issues was also included.

Table 2 – Evidence submitted for 'Higher percentage increase in condition control, supported by HMHM' (data to 31st May, 2018, unless stated otherwise)

Outcome definition – a 'control' metric, or an action known to improve condition control

Partner	Measure	Data source	What the evidence shows
Argyll & Bute	Increased condition control, supported by HMHM	Local staff survey	5 of 9 staff said Florence had improved clinical markers with patients/service users a little (n=4) or a lot (n=1)
Ayrshire & Arran	**Heart failure** – no. intervening as advised, supported by HMHM	Local data	20 people advised to use rescue medication (May '16 to Feb '18)
	COPD – no. intervening as advised, supported by HMHM	Local data	Average 12 people per month advised to commence rescue medication (May '16 to Mar '18)
	Mental health – no. completing CBT on-line programme, supported by HMHM	NHS24 data	More people complete the first CBT on-line session with Florence (n=356) compared to without Flo (n=108)
	Hypertension – no. diagnosed/monitored for medication titration to stabilise BP	Local data	601/854 (70%) diagnosed as hypertensive by May '18, 272/360 (76%) being monitored or completed for medication titration to stabilise BP
East Renfrew-shire	**Hypertension** – no. diagnosed/monitored for medication titration to stabilise BP	Local data	132/199 (66%) diagnosed as hypertensive by Apr '18, 86/199 (43%) have had hypertension stabilised
		Case study	Someone with poor medication compliance was able to accept they had high BP with Flo. Medication now taken as prescribed, BP at safer level
Glasgow City	**Diabetes** – increased condition control, supported by HMHM	Case study	Someone recently diagnosed connected their blood glucose meter to their computer at home and saw all their results displayed. He was motivated to change the colour, explaining he went from "all reds to now almost always green"
Highland	**Diabetes** – change in HbA1c, supported by HMHM	Case studies	Three people have reduced HbA1c after HMHM compared to before
	Heart failure – no. intervening as advised, supported by HMHM	External evaluation	Self-Care Heart Failure Index showed statistically significant improvement before and after HMHM
		Case study	Person changed diuretic dose after critical reading
	COPD – no. intervening as advised/feeling more confident, supported by HMHM	External evaluation	Clinicians report patients having better control. Increased prescriptions may be due to people taking rescue medications
	Mental health – no. attending local course	Local data	66 attended, published evidence shows this improves condition control
	Hypertension – no. diagnosed	Local data	128 diagnosed as hypertensive, or hypertension diagnosis ruled out
	Hypertension – no. intervening as advised, supported by HMHM	Local patient survey	One person "increased exercise regime and also aware of need to relax more", another "made changes to my diet to help get my BP down"

Partner	Measure	Data source	What the evidence shows
Lanarkshire	**Health improvement** – no. not smoking 4 weeks after quit date, supported by HMHM	Local data	15/19 SIMD 1&2 (79%) not smoking with Flo 4 weeks after quit date, compared to 63% of all SIMD 1&2
	Mental health – no. completing CBT on-line programme, supported by HMHM	NHS24 data	A higher % completed the first on-line session with Florence support than without (57% cf. 32%) in 2017/18. *(this has been shown to improve mental health and wellbeing)*
	Asthma – no. intervening as advised, supported by HMHM	Case study	One person's consistent wheeze had an adverse impact on their work. They started daily texting symptoms/readings, their peak flow increased from 410 to 520 in six months, they had fewer absences from work
	Hypertension – no. diagnosed/monitored for medication titration to stabilise BP	Local data	44% clinicians requested monitoring for diagnosis, 49% for medication titration. At least 799 people in '17/18 had diagnosis confirmed or excluded and BP medication titrated (if required)
		Case study	One person refusing to believe they had hypertension accepted their diagnosis after using Florence BP was then reduced from 183/87 to 135/80
Lothian	**Hypertension** – no. with BP maintained within set parameters/below certain thresholds	External evaluation	Reduced % patients with raised systolic/ diastolic BP readings e.g. 17.2% with systolic BP >150 in 1st month, decreased to 4.1% 10-12 months later
Midlothian	**Oral Nutritional Supplements** – no. gaining weight, supported by HMHM	Local data	25 people who participated in >15 Health Call sessions gained an average of 1.37kg. In contrast 26 completing <15 sessions lost weight (average of 0.83kg)
Tayside	**Health improvement** – increased condition control, supported by HMHM	Local data	7 mums-to-be had maintained quit status at 3 months, 32/46 (70%) had lost weight supported by Flo compared to 43/67 (64%) not on Flo
		Case study	Someone said they didn't mind telling Flo their weight and then saw what they achieved by following the protocol
West Dunbarton-shire	**COPD** – no. feeling more confident e.g. about using rescue medications	Local patient survey	All 12 people surveyed felt more confident to start their rescue medications because of Florence
Western Isles	**Diabetes** – increased condition control, supported by HMHM	Local data	By six months there was an average decrease in HbA1c of 5 mmol/mol (n=17). Sensors automatically stopped an insulin pump 339 times during the night to avert hypoglycaemia when people were sleeping
	Heart failure – no. intervening as advised, supported by HMHM	Case study	One person described knowing that when their data is downloaded any abnormalities will be identified via 'bossy Flossy' and action taken
		Local staff	People who struggle to control their weight have found that the act of texting it to Florence has helped them to get control of it
	Hypertension – no. monitored for medication titration	Local data	16 people are home BP testing for medication titration

2.3.7 HMHM OUTCOME – 'OPTIMISED FACE TO FACE CONTACTS, IF NEEDED, SUPPORTED BY HMHM'

Table 3 summarises the selected evidence that demonstrates contributions to this outcome.

Table 3 – Evidence submitted for 'optimised face to face contacts, if needed, supported by HMHM' (data to 31st May, 2018, unless stated otherwise)

Outcome definition – *face to face (f2f) contacts improved by HMHM results or contacts avoided i.e. available for others*

Partner	Measure	Data source	What the evidence shows
Argyll & Bute	No. f2f contacts/ appointments avoided by HMHM	Local staff survey	5/9 staff said Flo reduced telephone calls and 4/9 said it reduced appointments
Ayrshire & Arran	**Hypertension** – no. f2f contacts/appointments avoided by HMHM	Local data	448 people avoided 1,094 face to face BP appointments, 67 avoided 201 medication titration appointments (Apr '17 to Feb '18)
	Mental health – no. f2f contacts/appointments avoided by HMHM	Local data	GPs estimated that an average of 4 face to face appointments were avoided by people undertaking cCBT when supported by Flo, and an average of only 3 for cCBT participants without Flo support
	Diabetes – no. appointments where decision-making is improved by having results available	SCI-Diabetes	147 active Diasend users (Feb '18) uploading blood glucose readings through online portal, meaning they were available to healthcare professionals
East Renfrew-shire	**Hypertension** – no. f2f contacts/appointments avoided by HMHM	Local data	584 BP appointments avoided (Apr '18)
		Local staff	"Easier to review readings without patient there … I either text or phone them … easier to manage time for myself and the patient"
		Local patient	"Excellent not having to miss work to attend nurse for BP check"
Glasgow City	**Diabetes** – no. appointments where decision-making is improved by having results available	SCI-Diabetes	582 active Diasend users (Feb '18) uploading blood glucose readings through online portal, meaning they were available to healthcare professionals
Highland	**Asthma** – no. patients on biologics where decision-making is improved by patients texting in results	Local staff	"After an asthma patient is discharged from hospital, national guidelines state they must been seen within four weeks for a follow-up appointment. Data provided by Florence, reviewed at this appointment helps determine when I should see them again"
	Asthma – no. f2f contacts/ appointments avoided by HMHM	Local staff	"With my [HMHM] patients [those not on biologics] there has been a reduction in the number of clinic appointments they need"
		External evaluation	5 of 9 patients had fewer face to face GP appointments per month with HMHM compared to before
	COPD – no. f2f contacts/ appointments avoided by HMHM	External evaluation	3 of 4 patients had fewer face to face GP appointments per month after HMHM compared to before
	Heart failure – no. f2f contacts/appointments avoided by HMHM	Local staff	"I can put a patient on beta blockers with fewer appointments, because I can monitor their BP remotely"

Partner	Measure	Data source	What the evidence shows
Lanarkshire	**Diabetes** – no. appointments where decision-making is improved by having results available	SCI-Diabetes data	248 active Diasend users (Feb '18) uploading blood glucose readings through online portal
	Hypertension – no. appointments where decision-making is improved by having results available	Local data	1,997 people texted BP results to their GP surgery to support diagnosis/medication titration
	Hypertension – no. f2f contacts/appointments avoided by HMHM	Local data	4,756 clinical contacts avoided (Oct '17)
		Case study	One person who relied on family to bring them for BP checks felt dizzy and needed their medication changed. Starting Flo saved several appointments while medication changes were reviewed remotely
Lothian	Improved decision-making by patients having results available in advance of appointments	External evaluation	Quotes from a range of staff demonstrated how decisions to start medication or change treatment were based on the BP results texted in to the participating practices
West Dunbarton-shire	**COPD** – Reduced contact out-of-hours, fewer home visits, supported by HMHM	Local patient survey	11 of 12 people said they saw their GP less often since starting to use Florence
	No. feeling less anxious due to combined Flo and telecare	Local patient survey	2 of 4 people felt confident that their community alarm would be answered by someone who would understand that they were having problems with their COPD
Western Isles	**Heart failure** – no. appointments where decision-making is improved by patients bringing results to appointments	Local staff	Specialist nurse on video clip showed anonymised graph of data texted by a patient and described how she used such data from all her patients in clinic or during home visits
	Diabetes – no. f2f contacts/appointments avoided by HMHM	Local data	A sample of 8 patients had a total of 84 specialist nurse appointments in the year before HMHM and 35 the year after, there was a 96% reduction in GP appointments within 8 months
West Lothian	Flo translated into Polish	Case study	Florence text messages were translated into Polish to enable a patient to interact without needing an appointment

Evidence collated above, shows that use of HMHM has positively contributed to optimisation of face to face appointments/contacts across the partnerships. In some cases this was because blood sugar results were available in advance of diabetes appointments or clinicians had blood pressure results available to inform their decision-making without the patient needing to be present. Other evidence indicated appointments that HMHM patients would have used, but were able to be avoided and therefore available for others who needed them.

2.3.8 HMHM OUTCOME – 'IMPROVED ACCESS TO SERVICES, SUPPORTED BY HMHM'

Table 4 summarises the selected evidence that demonstrates contributions to 'improved access to services, supported by HMHM.

Table 4 – Evidence submitted for 'improved access to services, supported by HMHM'
(data to 31st May, 2018, unless stated otherwise)

Outcome definition – *HMHM prompting increased contact with services, a faster response, or HMHM instead of contact*

Partner	Measure	Data source	What the evidence shows
Argyll & Bute	HMHM instead of staff contact	Local patient	"Sharing BP readings with a medical professional [via HMHM] and the feedback received throughout encouraged me to be more aware of the need to control and monitor BP readings"
	HMHM prompting a faster response	Local staff survey	4/8 staff said their service better meets demand with Florence and 4/8 said their service was more responsive
Ayrshire & Arran	HMHM prompting a faster response	Local staff survey	More than half of the 30 respondents said they felt HMHM enabled more timely access to appropriate services e.g. earlier intervention for respiratory patients
		Local patient focus groups	One person who submitted his readings in the morning got a quick response from his doctor: "I was sitting in the car and the phone went" while another who normally had their BP checked with every 2nd/3rd repeat prescription explained, "within next to no time, I think it was about the second week, I got my medication [increased]"
	HMHM instead of staff contact	Local patient focus groups	One person whose Receptionist had told them the GP was increasing their medication said, "it was completely due to the machine because I hadn't seen the doctor, which I thought was fantastic"
East Renfrew-shire	**Hypertension** – HMHM prompting a faster response	Case Study	Within 24 hours of starting Flo, someone's shared management plan identified dangerously high BP and the need to contact services. They were admitted to hospital and started on medication. They had previously been unsure they had high BP
Highland	**Asthma** – HMHM prompting increased contact with services	Local data	120 people get a twice daily response to texting their peak flow readings via Flo
	COPD – HMHM instead of staff contact	Case study	Someone previously contacting clinical staff a lot gained confidence in understanding their COPD via Flo, then reduced contact with the team
	Heart failure – HMHM instead of staff contact	External evaluation	Clinicians said HMHM made it easier to check up on patients without relying on home visits. The Flo protocol pushes data tothe clinicians
Lanarkshire	**Hypertension** – HMHM prompting increased contact with services	Case study	One anxious person who was not keen to attend the GP surgery (they felt under pressure there) was more relaxed checking their BP at home and found it was within the normal range. Their engagement with the surgery has now increased
	Hypertension – HMHM instead of staff contact	Local staff	HMHM is particularly useful for people whose working hours clash with surgery opening, who are stressed at the appointment and have high readings. Now after initial visit to start Flo we follow up results by phone

Partner	Measure	Data source	What the evidence shows
Lothian	HMHM prompting faster response	External evaluation	For people with average systolic BP >160 i.e. high, the clinicians responded to their results in a median of 13 days (previously much longer)
	HMHM prompting increased contact with services	Local staff	"If I can see their BP is outwith the range, I'll get in touch and tell them to come in"
Tayside	**Heart failure** – HMHM prompting a faster response	Local data	The protocol alerts the specialist nurse if results are not within set parameters and 4 of these alerts led to quicker access to services, avoiding the patient's condition getting worse
West Dunbartonshire	**COPD** – HMHM prompting a faster response	Local patient survey	All 12 respondents felt they were able to access help for their COPD quicker because of Florence
	COPD – no. in non-engaged cohort who stayed in touch via HMHM	Local data	27 non-engaged patients stayed in touch via Flo
Western Isles	**Diabetes** – no. avoiding travelling to appointments	Local data	28 people avoided at least 1 specialist nurse appointment as a result of HMHM, some avoided more than 1
	Multiple sclerosis – staying in touch when previously did not engage	Local data	6/10 appointments were missed in the year before Flo, none were missed the year after
	Respiratory – HMHM prompting a faster response	Local data	50% reduction in waiting time for urgent cancer referrals
	Heart failure – HMHM instead of staff contact	Local data	No. referrals for ambulatory cardiac monitoring reduced from 70 per year to 30 per year after HMHM. One person had undiagnosed atrial fibrillation detected and treated
		Case study	A patient with normal results for all other tests had abnormal rhythm detected via HMHM. They emailed a report from the device to the cardiac physiologist who liaised with the GP to arrange treatment

From evidence outlined above, it is clear that use of HMHM improved access to services in a number of ways across the partnerships. There were numerous examples of HMHM prompting a faster response, either enabling clinicians to respond more quickly than before they had HMHM results available or patients/service users noticing they got a faster response. Many partners had evidence of HMHM replacing contact with staff, but added examples of how this had raised greater awareness amongst service users, improved their confidence to self manage without contacting staff, or detecting abnormalities that might otherwise have been missed. In some cases, HMHM prompted increased and appropriate contact with services e.g. from staff noticing deteriorations , or patients feeling more comfortable engaging regularly with services.

2.3.9 HMHM OUTCOME – 'RESOURCES ARE USED EFFECTIVELY AND EFFICIENTLY'

A number of partners presented good evidence to demonstrate their contributions to national health & wellbeing outcome no. 9, and their results are included in Table 5. This will be explored in great detail when the HMHM economic evaluation is published later in the year.

Table 5 – Evidence submitted for 'resources used effectively and efficiently'
(data to 31st May, 2018, unless stated otherwise)

Partner	Measure	Data source	What the evidence shows
All partners	No. self-managing condition, controlling condition	Various	Evidence presented for 'Higher % population self-managing' and 'Higher % increase in condition control' shows very many examples of responsibility shifting away from healthcare professionals to patients/ service users. This not only makes the services involved more efficient, but generally increases the effectiveness of the interventions
All partners	No. reduced referrals, clinic appointments, home visits	Various	Evidence presented for 'Optimised face to face contacts' and 'Improved access to services' shows a wide range of examples of avoided clinic appointments, referrals, home visits and telephone calls across the participating partnerships
Lothian	Change in cost of **hypertension** HMHM over time	External evaluation	Calculated that there could be a 25% reduction in cost of hypertension monitoring over time, depending on the staff involved and equipment used

Lothian's evidence in Table 5 was calculated from their experience of practices changing to healthcare assistants recruiting patients instead of nurses, reducing the time commitment needed, and the cost of equipment decreasing over time. The remainder of Table 5 comprises a summary of the evidence presented in Tables 1 to 4 because many of the changes effected by HMHM also produce efficiencies and often more effective interventions e.g. when patients/service users know more about why they should comply with advice offered.

2.3.10 HMHM OUTCOME – 'HOSPITAL ADMISSIONS AVOIDED BY HMHM'

Evidence on the impact of HMHM on hospital admissions was collected by some partners and their results are shown in Table 6. It should be noted that evidence for this outcome was not solicited, so there may be other evidence that was not submitted for inclusion in this report. And there are a number of examples in Tables 1 to 4 that suggest HMHM has enabled health issues to be identified earlier or an intervention actioned earlier than it might otherwise have been, thus avoiding a worsening of a condition that may have resulted in a hospital admission/ readmission. Although it is not possible to count the admissions avoided in such circumstances, there is a wealth of evidence, particularly in Table 2, where hypertension, asthma and diabetes interventions prompted by HMHM are likely to have avoided hospital admissions.

Table 6 – Evidence submitted for 'hospital admissions avoided by HMHM'
(data to 31st May, 2018, unless stated otherwise)

Partner	Measure	Data source	What the evidence shows
Highland	**COPD**, **heart failure**, **asthma** – no. avoidedhospital admissions	External evaluation	No. admissions for COPD, heart failure and asthma decreased substantially in the six months after HMHM started compared to the six months before
Tayside	**Heart failure** – no. avoided hospital admissions	Local staff	Nurse has reported 6 amber alert follow-ups. 4 led to unscheduled check-ups for patients who would have been a re-admission risk if they had let their condition continue. So 4 potential re-admissions were avoided by Florence

Highland's evidence is drawn from their external evaluation (Wolters, 2017) and shows that hospital admissions were avoided for COPD, heart failure and asthma. Some caution is advised by Wolters since the numbers involved are fairly small. It may be possible to follow up this work in future to determine if the early results are sustained. Tayside submitted smaller scale results from one of their heart failure nurses who contended that four from a sample of six patients were at risk of hospital admission and the HMHM alert helped to ensure action was taken that avoided this.

2.3.11 HMHM OUTCOME – 'PEOPLE HAVE POSITIVE EXPERIENCES OF SERVICES, SUPPORTED BY HMHM'

Many of the partners provided evidence directly from their patients/service users that showed what effect HMHM had had on their experience of engaging with services. A summary of some of the highlights is shown in Table 7. Again, evidence associated with patient experience was not sought out, which explains why a couple of partners are not represented in this table. This does not mean that they are unable to demonstrate improved patient experience, simply that no evidence for it was received.

Evidence presented in Table 7 is a clear demonstration of how positively people viewed their use of HMHM, no matter what method was used to capture them. The surveys were based on fixed responses, which is why additional comments have been included in the table. The interview and focus group results explore a wider range of issues, including people's perceptions that HMHM made them feel more connected to clinicians, that the readings they submitted mattered and were being used to inform decision-making, and that HMHM provided invaluable support and reassurance.

There were a couple of negative comments, some from people who had stepped down from using a technology solution which provided personalised visual feedback to a SMS-only based solution. Others noted that mobile phone signals could be poor in remote areas, that SMS based solutions such as Florence sometimes relied on them replying quickly, and that it felt a bit automated at times. The last comment contrasts with a Western Isles case study where the person felt her heart failure abnormalities would be identified via "bossy flossy" and that she expected "her" to be part of her life from now on.

Table 7 – Evidence submitted for 'people have positive experiences of services, supported by HMHM' (data to 31st May, 2018, unless stated otherwise)

Partner	Measure	Data source	What the evidence shows
Argyll & Bute, Ayrshire & Arran, East Renfrewshire, Highland, Lanarkshire, Lothian, Tayside, West Dunbarton-shire, Western Isles, West Lothian	Patient surveys, interviews, focus groups	Various	Feedback about HMHM from patients/ service users is overwhelmingly positive

When people completed **surveys** about HMHM they said that they gained knowledge about their health, they felt more in control and that Flo helped them manage their condition & take action when needed. One person used the word 'transformed' when describing its impact on their life. Comments included, "I liked being able to [monitor] without taking up the nurse's time", "I like that Florence reminds me to do my BP. No improvement needed to the service – more like this are needed to take pressure off the NHS" and "It was fantastic. It really reassured me because of my family history of high blood pressure".

Negative **survey** comments included that it felt a bit automated and could be intrusive if replies were not sent quickly enough.

During **interviews** people said they valued the immediate feedback from Florence and that HMHM provided "much-needed support". Others felt that HMHM meant they were connected to their clinicians and they knew that the readings they submitted mattered. They knew that better decisions could now be made during appointments, based on HMHM results, and that the rationale for these decisions was clearer to them. Some people felt that Flo had helped them to stay on track while others said it gave them reassurance, 'like somebody's looking over my shoulder just keeping an eye on things'.

Negative **interview** comments came from a few people who had changed from having a lot of data displayed visually on a pod to only text messages from Flo; they said they missed the easy access to their graphs to support their self-management. Others noted that IT infrastructure did not always support HMHM, particularly mobile phone signals in remote areas. One person who knew that Flo was automated felt it might be nice occasionally to hear from a real person instead.

Focus groups generated a lot of evidence around the agreed HMHM outcomes e.g. one person said, "You're made to feel that they are actually there, looking after you. You're not just at the end of a phone, you're not just on a tablet, there is a personal connection". Another who felt in a frightening situation when diagnosed said, "the support you get is, really, I have to say, invaluable". The reassurance described also spread to carers, with one saying, "you've got somebody, you're not just the one that's there with him, you feel as if somebody else is there, to help you along". Specifically in relation to people's experience of HMHM, focus group participants were overwhelmingly positive. They thought Florence was "great", they felt the NHS had looked after them well, and they would definitely recommend HMHM to others. Perhaps unsurprisingly, this group had found no problems with using HMHM, saying it was simple to understand and well-explained. One concluded, "I've enjoyed it that much, I've actually got my own set now."

The only negative **focus group** issues raised were a slight confusion over whether or not the results were being reviewed by a clinician, readings being rejected if replies were not sent quickly enough, and requests for a practical demonstration of the blood pressure cuff rather than written instructions. *(Note – practical demonstrations are common, so may just have been missed on occasion.)*

2.3.12 ALTERNATIVE EXPLANATIONS FOR THE HMHM OUTCOME RESULTS

In addition to Contribution Analysis enabling the claim that an intervention has made a difference, Mayne (2012) says that rival explanations for the results observed need to be identified and their influence either acknowledged or discounted. This is because the evidence gathered to support a theory of change is considered to be making a contribution to observed results and other factors could have greater impact. Although Mayne suggests that rival explanations should be surfaced along with the theory of change, he also says he is supportive of modifying the six CA steps. This evaluation was felt to be sufficiently complicated to delay exploring rival explanations until step 5 and they are presented in Table 8 in relation to each of the main Year 3 HMHM outcomes.

Exploration of possible rival explanations for the evaluation results in Table 8 generally supports the claims of contributions to HMHM outcome achievement. The only exception is in relation to hospital admissions avoided, where the evidence relies on relatively small numbers that may be unrepresentative of everyone using HMHM. In addition, some people may be unwell enough to need hospital admission in spite of using HMHM.
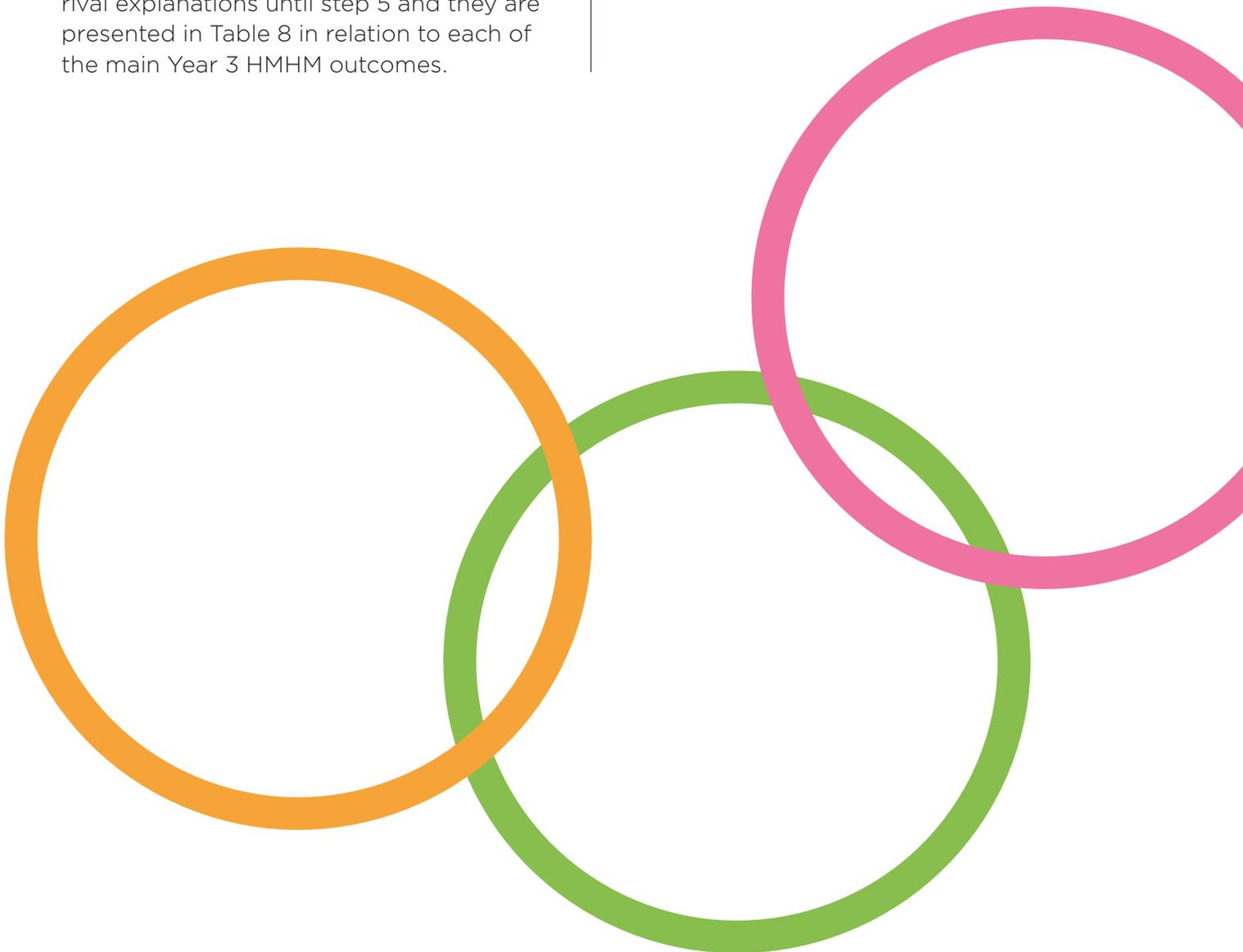
Table 8 – Exploration of rival explanations for observed HMHM results

Claim	Rival explanation for results	Rival explanation supported or rejected
That HMHM enables a higher percentage of the population to self- manage than would have done so without HMHM	The people participating in HMHM have self- selected because they are pre-disposed to self- manage	**Rejected** – local data and case studies describe people who were not previously self-managing, so unlikely to be pre-disposed to do so
	The people participating in HMHM are only complying with an instruction from their clinical team, not actively self-managing	**Rejected** – local surveys, data and case studies describe people's increased motivation/knowledge and better adherence to recommendations
	The people participating in HMHM may be motivated to self-manage because of something else happening in their lives that is unrelated to their use of HMHM	**Rejected** – many Flo protocols are enabling success with intractable or long-standing issues and there are no indications of any additional, unrelated catalysts for change
That HMHM enables a higher percentage increase in condition control than would have happened without HMHM	The people participating in HMHM may have experienced a spontaneous improvement in their condition, unrelated to HMHM	**Rejected** – most of the conditions included in Table 2 are long-term, deteriorating over time and people report their motivation arising from HMHM
	The people participating in HMHM may have had a change to their management regime e.g. medication prescribed, which would explain why their condition improved	**Rejected** – most of the evidence describes management regime change as a result of HMHM, not prior to/at the same time as HMHM. Also some evidence has non-HMHM comparator groups that have poorer condition control
That HMHM has enabled optimised face to face contacts, if needed	The people participating in HMHM have inaccurate perceptions of any change to face to face contacts	**Rejected** – although possible for some conditions, hypertension HMHM does result in fewer contacts
	Some of the small numbers supporting this claim may not be representative of the impact	**Rejected** – although possible for some conditions, there is no such debate with the larger numbers
	Data on reduced appointments may be the result of improved condition control, not due to HMHM	**Rejected** – most of the conditions are long-term and without HMHM require to be seen
That HMHM has improved access to services	The people participating in HMHM may have inaccurate perceptions of any changed access to services	**Rejected** – people clearly describe examples of faster access to services, quick responses, and an increased number of responses from Florence
	The people participating in HMHM may just have demanded quicker access to services due to something unrelated to HMHM	**Rejected** – many people describe HMHM prompting increased access or alert responses, not something they would normally expect
That HMHM has avoided a number of hospital admissions	The small numbers supporting this claim may have an unrepresentative pattern of admissions	**Possible** – further data may find people who have increased admissions, countering this claim
	The hospital admissions avoided may not have been due to HMHM	**Possible** – the people using HMHM may have benefited from other supports besides HMHM
That HMHM results in a positive patient/ service user experience	The people providing feedback may be an unrepresentative sample	**Rejected** – the people providing feedback on their experience were not universally positive, but if there had been major problems you would expect more negativity to be voiced and individuals to stop participating

3 TOWARDS HMHM SCALE-UP, SPREAD AND SUSTAINABILITY

3.1 SCALE-UP, SPREAD AND SUSTAINABILITY OF HMHM IN SCOTLAND

The following definitions are used in the remainder of this report, but, as will be apparent in the following sections, there is a need to agree nationally what they mean in practice, especially for HMHM. Greenhalgh et al (2017) define scale-up, spread and sustainability as follows:

- **Scale-up** – moving from a local project to one that is 'business as usual'
- **Spread** – transfer to new settings
- **Sustainability** – maintained long-term, adapting as required

3.1.1 SCALE-UP

Our national service model framework (Scottish Government, 2017) defined scale-up as having 1,000-5,000 active patients/ service users by 2018/19. By this definition, and allowing for some having relatively small populations, **six of the 12 (50%) partnerships have achieved the level of scale-up** set out in this model.

Alternatively, scale-up success may also be judged in terms of the 15,765 people who have benefited. Table 9 identifies the proportion with the most prevalent conditions that have been facilitated to use HMHM.

Most HMHM protocols to date have been developed for community-based services, hence the use of Quality and Outcomes Framework (QOF) data on prevalence, it being the most appropriate that is currently available. Diabetes prevalence is more reliable as it is published annually in the Scottish Diabetes Survey.

Table 9 is presented in the context of considerable increases in the numbers having used HMHM in the past three years (see Figure 3), but they are likely to be an underestimate as others may have used HMHM without it being recorded. However, it is still worth benchmarking progress to date. Table 9 shows that for the main conditions where separate data was available, the total percentage that had the opportunity to use HMHM was 1.4%. The number using HMHM for remote blood pressure monitoring are the most advanced of all the conditions, and although the proportion of people with high blood pressure using HMHM varied between partners (range 0.3 to 2.3%), overall 1.6% had this opportunity. The proportion using HMHM for COPD and asthma was also advanced, but less so for diabetes and mental health. It should be noted Scotland already has an HMHM diabetes software solution as part of the *My Diabetes My Way* suite of online resources developed through United4Heath. It is also worth remembering that the protocol definitions varied across partners, so people grouped together in the condition totals in Table 9 were not always using HMHM for the same purpose. Nor had all the partners been using HMHM for the same length of time, which partly explains the difference in numbers.

Further work is needed to identify what would represent reasonable scale-up for a given condition and this will in turn drive forward population health benefits at scale. Scale-up for HMHM moves on very quickly and the numbers are greater now than when this data was gathered, but it will require longer than three years of investment and implementation support to reach a population-level tipping point.

Table 9 – Proportion of each partnership population using HMHM

Condition	Partner	No. using HMHM	Mid-2017 population estimate*	Estimated condition prevalence†	% used HMHM
Hypertension	Argyll & Bute	178	86,810	12,067	1.5
	Ayrshire & Arran	1183	370,410	51,487	2.3
	East Renfrewshire	243	94,760	13,172	1.8
	Highland	132	321,990	44,757	0.3
	Lanarkshire	1997	658,130	91,480	2.2
	Lothian	1769	889,450	123,634	1.4
	Western Isles	16	26,950	3,746	0.4
Hypertension total		**5,518**		**340,343**	**1.6**
Mental Health†	Argyll & Bute	127	86,810	5,903	2.2
	Ayrshire & Arran	356	370,410	25,188	1.4
	Highland	66	321,990	21,895	0.3
	Lanarkshire	559	658,130	44,753	1.2
Mental Health total		**1,108**		**97,739**	**1.1**
Diabetes	Argyll & Bute	42	86,810	4,688	0.9
	Ayrshire & Arran	163	370,410	20,002	0.8
	Glasgow City	582	621,020	33,535	1.7
	Highland	128	321,990	17,387	0.7
	Lanarkshire	248	658,130	35,539	0.7
	Western Isles	36	26,950	1,601	2.2
Diabetes total		**1,199**		**112,752**	**1.1**
COPD	Argyll & Bute	44	86,810	1,997	2.2
	Ayrshire & Arran	270	370,410	8,519	3.2
	Highland	114	321,990	7,406	1.5
	Lanarkshire	104	658,130	15,137	0.7
	West Dunbartonshire	82	89,610	2,061	4.0
COPD total		**614**		**35,120**	**1.7**
Asthma	Highland	132	321,990	7,406	1.8
TOTALS		**8,571**		**593,360**	**1.4%**

*   Source – Population estimates by administrative area, National Records of Scotland (NRS, 2018)

†   Source – Prevalence estimates from Quality and Outcomes Framework (QOF) data for 2015/16 (ISD, 2016) or the Scottish Diabetes Survey 2016. Note, Mental Health is defined in QOF as serious mental illness, so the depression estimate is used instead in Table 9

NOTE – other areas not included in this evaluation may be using HMHM for these and other conditions

3.1.2 SPREAD

The national service model also projected that by 2018/19, most partners would have spread HMHM across 2 to 8 pathways of care and used 1 to 3 different media channels i.e. text messages, tablets, web sites etc. By this definition, **eight of the 12 partnerships have achieved the expected level of spread**. Two others may get there by the end of the programme and spread for a third was never part of their HMHM funding plan (spread across this area was supported by other sources of funding). Spread in future needs to include many new settings beyond the 12 HMHM funded partners to include other parts of Scotland.

3.1.3 SUSTAINABILITY

Although not an aim of the HMHM Programme at the outset, it is worth considering what we have learned thus far that could inform sustainability. There is a high risk that if suitable resourcing is not allocated to support the continued scale-up and spread of HMHM across Scotland its potential will not be realised. Efforts also need to be made to retain knowledge and HMHM expertise within the workforce developed over the course of the programme and continue to develop digital health and care leadership roles for HMHM.

In addition, more work is needed across the NHS and health and social care partnerships to embed the learning and successes to date across whole pathways of care and to spread to other conditions and new digital technologies as they become available. It is becoming increasingly important for NHS boards and Integrated Joint Boards to capitalise on the benefits of embedded digital health and care/TEC, and specifically remote monitoring, as key enablers of service transformation programmes in Scotland. A hands-off approach at this stage is a major threat to long-term maintenance and the radical new ways of working that HMHM offers.

3.2 SUCCESSES AND CHALLENGES EXPERIENCED BY THE PARTNERS

Each of the 12 partners completed templates describing their successes and challenges and these were repeatedly reviewed to identify the main themes emerging. Not surprisingly, none of the themes that the partners identified were new but they have been collated in Table 10.

The fact that the themes in Table 10 have all been recognised in existing literature (either academic publications or technology-related reports) suggests that something more radical is required than simply reiterating known facilitators and barriers. The work by Greenhalgh et al (2017) creating a framework based on a wealth of systematic reviews of technology implementation provides an opportunity to go beyond what is already known. This is fairly new, so they also say that it needs to be subjected to further empirical testing.

3.3 A FRAMEWORK TO EVALUATE THE SUCCESS OF HMHM

The **N**on-adoption or **A**bandonment of technology by individuals and difficulties achieving **S**cale-up, **S**pread and **S**ustainability (NASSS) framework was developed to help predict and evaluate success or otherwise with health and social care technologies such as HMHM. Greenhalgh et al (2018) have just published the first application of their framework and found levels of complexity across many of its domains that explained the 'failures, partial successes and unanticipated problems' encountered. They propose a series of principles to follow, but point out that it is often vital to reduce complexity across as many of the NASSS domains as possible. Their experience provides a reference point for applying it to the data available for HMHM in Scotland (Table 13). Full details of the NASSS framework and its application can be found on-line as both articles are open access.

Table 10 – Successes and challenges experienced by the 12 HMHM partners

Theme	Successes	Challenges
Response to the technology	Clinicians see the clear benefits Patients/service users like the technology People relate to Florence as a person	Patients/service users not engaging with HMHM Staff forgetting to offer HMHM to patients
Knowing the context	Understand how things work in the service Start small, build momentum Minimise time commitment for clinicians Respect patient-practice dynamic Assess readiness for HMHM	Perception that HMHM is a project that will end soon Perception that HMHM will increase workload Fear of technology/need to focus on the basics Perception that patients can't be trusted to monitor their own health Some clinicians not convinced of HMHM evidence base
Characteristics of the technology	Simple, inexpensive technology Keep protocols as simple as possible Prepared to try any technology that might work	Prohibitive cost of some technologies Difficult to co-ordinate delivery and installation
People and relationships	Dedicated TEC team for all HMHM requirements Team enthusiasm, perseverance and availability Dedicated Programme Manager Well-respected Clinical Champions to open doors Strategic leadership/support/integrated board Local evaluation/analyst support Build on existing trust/good working relationships	Need more TEC staff than can afford Lack of GP clinical leadership Key staff moving on/change of personnel Dispersed teams – engage each part like new Staff not feeling ownership if not developed protocols TEC recruitment delays, then difficult to retain expertise Technology literacy varies amongst clinicians
Spreading the word	Use good results to generate further interest Positive patient feedback to spread the word Make patient experience videos accessible on-line Capitalise on opportunities as they present Tailor invitations to help resolve issues being faced Winning awards gets recognition/political interest How staff present HMHM/buy-in to drive uptake	Reluctance to embrace change/cultural resistance GPs not wanting or having no time to consider change
Systems and linkage	Integration with existing systems eHealth input to access HMHM data/reports Work with Procurement to get best price, share this	Poor mobile phone signal in some parts of Scotland Complicated arrangements to access HMHM data Provider slow to respond to change requests Integration with existing systems *(more partners found this a challenge than a success)*
Learning from others	Partners shared early experience and resources Early adopters to iron out teething problems	Lack of knowledge of partner organisation processes No local support for producing business cases
Flexibility of plans, responsiveness	Recognise when things not working/need to change Adapt to different populations Align technologies to local strategies in development	Work around needed for budget transfer
Becoming the way things are done now	HMHM as part of the service, not an added option Reach a tipping point/snowball effect Confidence is growing – people are asking for HMHM	Lack of time to do everything

The NASSS framework was initially presented in the form of a table (Greenhalgh et al, 2017) with three possible levels of complexity for seven dimensions; simple, complicated and complex. Many of the seven dimensions were sub-divided according to key relevant issues that had been reported in systematic reviews of published literature. The three possible levels for each dimension were reviewed repeatedly, along with the information on successes and challenges provided by the 12 partners and the evidence they submitted in relation to outcome achievement. Table 11 includes only the complexity ratings arrived at for each of the NASSS domains/sub-divisions, and not the other definitions. However, these can be found in the open access publication and since Table 11 is intended as a starting point, further debate of the ratings is warranted.

Table 11 – Complexity rating of HMHM programme – applying the NASSS framework to the completed partnership templates and the associated common themes (outlined in Table 10)

NASSS domain	HMHM theme	Complexity ratings of different aspects of each NASSS domain
The condition or illness	*No related HMHM themes emerged*	**Simple:** most HMHM conditions are well-characterised, well-understood, predictable **Complicated:** socio cultural factors and co-morbidities must be factored into care plans and service models
The technology	Response to the technology	**Complicated:** most HMHM technologies are not fully interoperable or 100% dependable **Simple:** HMHM directly and transparently measures the condition or changes in it **Complicated:** detailed instruction and training is often needed, along with ongoing helpdesk support **Complicated:** customisable, off the shelf solutions required local development and substitution would be difficult if the supplier withdrew
The value proposition	Knowing the context	**Simple:** The developer's business case for HMHM is clear with a strong chance of return on investment **Simple:** HMHM technology is desirable for patients, effective, safe and mostly cost-effective
The adopter system	Characteristics of the technology	**Complicated:** existing staff must learn new skills and/or new staff need to be appointed **Complex:** patient/carer may need to initiate changes in therapy, make judgements, organise **Simple:** no inherent need for a carer to be available
The organisation	People and relationships Spreading the word Systems and linkage Learning from others	**Complicated:** organisations have limited 'slack' resources, leadership not always optimal, risk taking not encouraged **Simple:** high tension for change, good system fit, widespread support for HMHM **Complicated:** multiple organisations in partnership, cost-benefit favourable or neutral, new infrastructure can mostly be found from repurposing **Complicated:** new team routines or care pathways readily align with established ones **Complex:** considerable work needed to build shared vision, engage staff, enact new practices and monitor impact
The wider context	*No related HMHM themes emerged*	**Complicated:** financial and regulatory requirements negotiated nationally, professional and lay stakeholders not yet fully committed
Embedding and adaptation over time	Flexibility of plans, responsiveness Becoming the way things are done	**Complicated:** the potential for adapting and co-evolving the technology and service is limited or uncertain **Complicated:** limited organisational resilience as sense-making, collective reflection and adaptive action are difficult and viewed as a low priority

Although not fully aligned, and still undergoing further testing, the NASSS framework has proved useful for evaluating the complexity of the HMHM programme. Table 11 shows that the majority of the aspects of each NASSS dimension were 'complicated', six were rated as 'simple' and two as 'complex'. Greenhalgh et al (2018) say that programmes with mainly complicated domains were 'difficult, slow and expensive' but not impossible to implement, whilst those with considerable complexity were rarely ever mainstreamed.

Although there needs to be further debate of the complexity ratings assigned in Table 11, if the proposed mainly 'complicated' characterisation is accepted, then scale, spread and sustainability will only be achieved if conditions are in place which reduce the level of complexity for some of the domains. Greenhalgh et al (2018) propose some core principles that may increase the likelihood of success, namely assessing programme complexity (as in Table 11), establishing overall leadership and a shared vision, creating incentives and responding adaptively as the programme evolves, controlling over-ambitious extension/scope creep, ensuring there is slack in the system, and managing the tension between the desire to innovate and the need to implement.
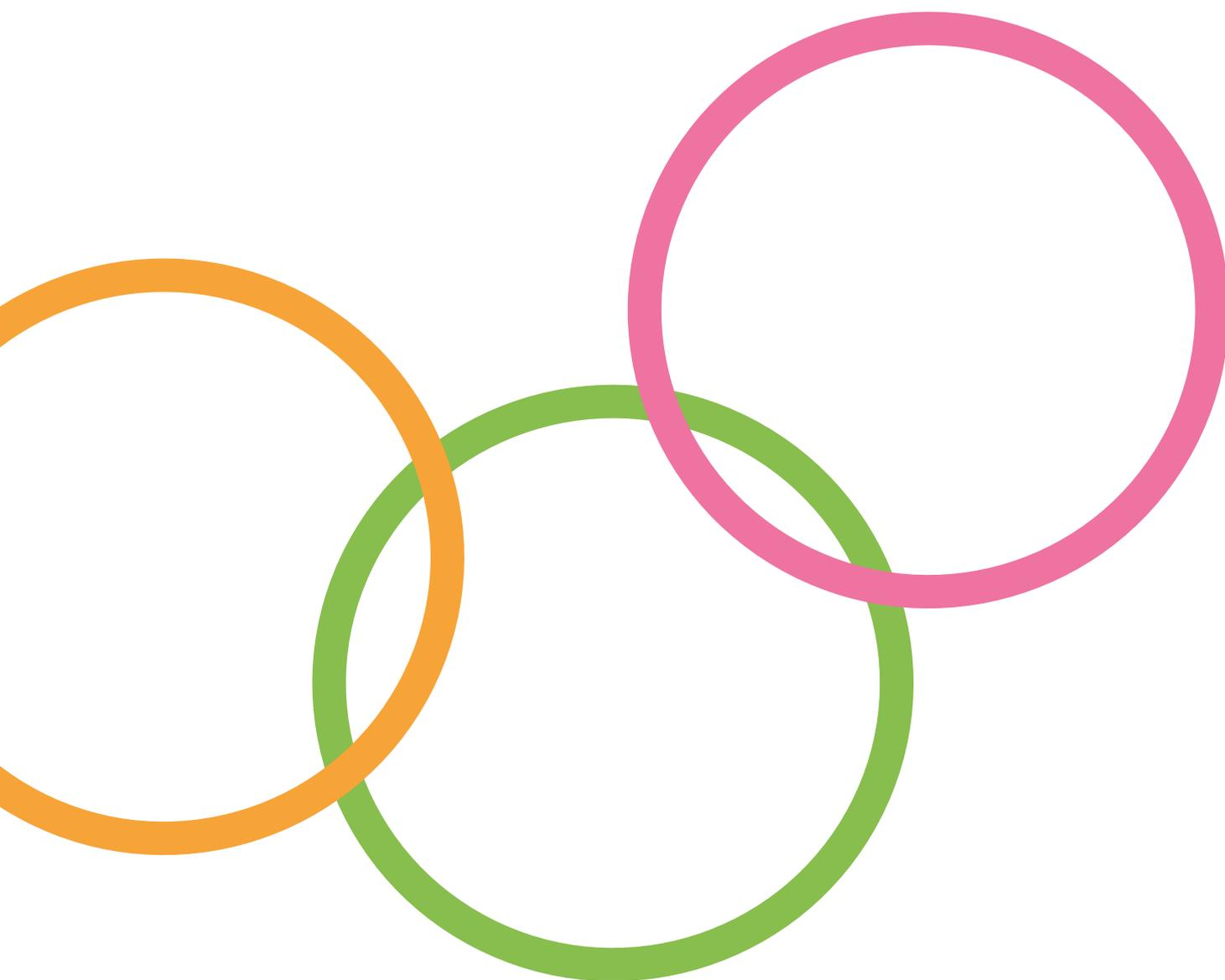
4 DISCUSSION AND IMPLICATIONS FROM THIS EVALUATION

4.1 DOING THINGS DIFFERENTLY WITH EVALUATION METHODOLOGY

The policy context for HMHM in Scotland is ambitious, notably the drive for radical change in health and social care services to be facilitated by technology adoption. There is a strong underlying assumption that technology has the ability to effect major system change and this is supported by the publication of considerable successes to date.However, much of the evidence this is based on is at randomised controlled trial or qualitative research level, which may not sufficiently account for the inherent complexity involved in the roll-out of new technologies (Imison et al, 2016). A focus on the technology itself is unlikely to lead to the kind of radical change suggested in recent policy documents, rather methodologies that can absorb all the associated complexity are needed (Just Economics, 2018). Greenhalgh et al (2016) call this 'fourth generation' and it chimes with the shifting trends in evaluation where theory-based approaches are often the methodology of choice.

The Contribution Analysis approach adopted in the first part of this evaluation set out the theory of how HMHM was to effect change in a logic model (Figure 2). This theory of change was then used to assemble evidence of how the HMHM partners had contributed to achievement of the desired outcomes. Whilst there is considerable published literature on the outcomes that a number of remote patient monitoring technologies can achieve (e.g. Totten et al, 2016, McKinstry et al, 2013, Wild et al, 2016), much of this work is research-based, with strong academic leadership. What we haven't had to date is 'good enough' evidence of technology deployment at a local level that can be aggregated to explore its impact at scale. Contribution Analysis does not relinquish rigour, since only evidence that is deemed to be sufficiently robust is included, but the descriptor 'good enough' covers the fact that it was not possible (nor arguably desirable) to control all the conditions under which data was gathered. In some cases, academics were commissioned to undertake evaluations, but in most partnerships the data was collected via a range of methods appropriate to local circumstances. The partners should be applauded for their approach to evaluation and for the wealth of evidence they generated. The support of the external evaluators appointed by two partners is also acknowledged.

At the end of HMHM Year 1, Hudson (2016) was clear that an evaluation of the TEC programme 'would require work of much greater depth, breadth and duration' than his scoping exercise could achieve. He noted at the time that much of the TEC activity was concerned with setting up processes that would yield benefits in time and that 'evidence of improvements in service delivery' would come later. After acknowledging the difficulties of establishing cause and effect within complex systems, Hudson suggested the HMHM logic model was an exemplar that could be useful in a pragmatic approach to establishing links between inputs and observed results. This is what Contribution Analysis has allowed the HMHM programme to do for Years 2 & 3.

The recent TEC review (Just Economics, 2018) presented a programme level version of the HMHM logic model and noted that the evidence mapped against it was the 'most well-developed' of the five TEC workstreams. The Just Economics review covered all five workstreams, so their findings are at the macro programme level, but they recommended building on successes to date, not least in emphasising the importance of evaluation to support continued progress. The past two years of Contribution Analysis (CA) has benefited from sufficient time and resource to approach the evaluation of the HMHM workstream at greater depth. By dint of its evolving nature and its implementation across the HMHM programme, the CA evaluation has ensured the generation of accurate, detailed findings from the funded partners and has used their experiences to inform the conclusions reached at this point in time. This would not have been possible without the full co-operation of the HMHM partners, or the dedicated evaluation resource, both of which were guided by an expert Steering Group.

4.2 THE IMPACT OF HMHM ON OUTCOMES

The HMHM logic model not only clarified what the partners could achieve, but its early development enabled a three year dialogue around evaluation and benefits realisation. This provided opportunities to establish what evidence each partnership could submit, but also where they had gaps and how these could be filled. The resulting data forms a major component of this report, but more importantly many partners have robust evidence for their own local business cases to support sustainability.

The achievements made by the 12 funded HMHM partners have been considerable. This is a programme that started from a low base in 2015, had passed the 5,000 user mark by the end of Year 2, and reached more than 15,000 by June 2018.

The increase in uptake of HMHM during Year 3 of the programme was double what it took the first two years to achieve, so we can conclude that considerable progress was made during Year 3 of the HMHM programme.

The most common 'conditions' HMHM in Scotland has shown traction with, are hypertension, mental health, respiratory and heart disease, and diabetes. Most of the evidence included around outcome achievement relates to these, which is appropriate since they comprise many of our key health priorities. But evidence is also presented for health improvement, asthma, intermittent claudication, Oral Nutritional Supplements, Cystic Fibrosis, autism and multiple sclerosis. There are many other HMHM protocols currently in use and new ones being developed all the time.

It was agreed to focus on four main outcomes at the end of Year 3, largely because contributions to achievement of the shorter-term outcomes from the logic model had already been evidenced in Year 2 (Alexander, 2017). The evidence published in this report (Tables 1 to 4) shows robust evidence across the partnerships of the contribution of HMHM towards achieving

- a higher percentage of the population self-managing
- increased condition control
- optimised face to face contacts
- improved access to services.

There was also good evidence submitted of contributions to resources being used more effectively and efficiently, hospital admissions avoided and positive patient/ service user experience. The evidence submitted took many forms and although more is available, this report selected a range of methods and conditions to demonstrate the breadth and depth of evidence gathered.

Contribution Analysis has proved to be a useful method for collating evaluation results across 12 partners and the range of conditions, technologies and data gathering methods they employed. Not only do we have evidence of contributions to outcome achievement, but there is considerable detail on the experience of patients/service users who were overwhelmingly positive about HMHM. It could be argued that these are early adopters of new approaches and therefore more likely than others to be positive, but this can be countered by evidence in case studies and video clips where people described how they were definitely not technophiles. Some focus group participants related how they relied on family members to help them with HMHM and one even humanised Florence by calling her "bossy Flossy".

Contribution Analysis also requires a consideration of risks to the theory of change (Mayne, 2012) i.e. that the results observed may be due to something unrelated to the programme being evaluated. For this reason alternative explanations for the outcome results were considered (Table 8) and this provided a degree of confidence that HMHM has indeed made a contribution to their achievement. The only exception related to the avoidance of hospital admissions where the alternative explanations could not be discounted.

4.3 PROGRESS WITH SCALE-UP, SPREAD AND SUSTAINABILITY

Each HMHM partnership has had a unique journey from start to the present day with much learning to share. A summary is presented in Appendix A. Two important factors are worth highlighting. Firstly, the partners have displayed considerable enthusiasm and commitment in implementing HMHM, something that has been at times challenging. Secondly the collaboration between the HMHM partners and with the National HMHM Team is very obvious, both in sharing learning and related resources amongst themselves, but also beyond Scotland whenever asked.

Whilst acknowledging how much success the partners have achieved, the level of scale, spread and sustainability needs to be considered. The numbers within each partnership have risen steadily and they have managed to spread across a range of conditions and technologies over the past three years. In terms of the aspirations described in the national HMHM service model (Scottish Government, 2017), half of funded partners achieved the expected scale-up and two thirds the level of spread that was hoped for and this work is ongoing.

At a population level, there is clearly more HMHM activity required. Without continued

policy and implementation focus there is unlikely to be sufficient scale-up or spread and impact on systems and services to realise the benefits that remain possible. It should be noted that the numbers included in this report are likely to be an underestimate since they are only from people recorded as having used HMHM and there is other work in Scotland not funded by this programme. Of the main conditions that have benefited from HMHM, hypertension is closest to scale, but it has reached only 1.6% of all those with high blood pressure. At a Health Board population level, Western Isles has spread to 3.1% of the people who live there, but they still have a way to go to consider HMHM as sufficiently scaled-up. Hudson (2016) warned that TEC would 'take time to demonstrate effect' and it doesn't feel like it has had long-enough yet. However, there is currently no agreed level of scale-up or spread for Scotland, either in overall terms or at an individual condition level. In addition to the need for more time, a clear plan is required that includes a target level of scale-up, or preferably a series of targets for the different conditions involved.

Although not one of the original HMHM programme aims, in order to sustain the progress made to date and build on what has been learned thus far, there is a need to retain and continue to exploit the expertise developed with HMHM across Scotland. Within the context of strong national support, local NHS boards and health and social care partnerships need to build HMHM (and other aspects of TEC) into their service plans. These ongoing investments need to plan for the inherent challenges, and acknowledge how long it can take to realise the full benefits, so that HMHM can become 'business as usual' in time.

It is timely that Greenhalgh et al (2017, 2018) identified the need to go beyond the myriad lists of facilitators and barriers to successful implementation of new technologies. With a sound theoretical basis, these authors have developed a useful framework for determining a programme's complexity and have tested it in the field. Although they say it needs to be applied more, its use has suggested that the implementation of HMHM in Scotland is challenging and will continue to be on a number of levels but largely because the work area has a number of complicated domains, and elements of complexity.
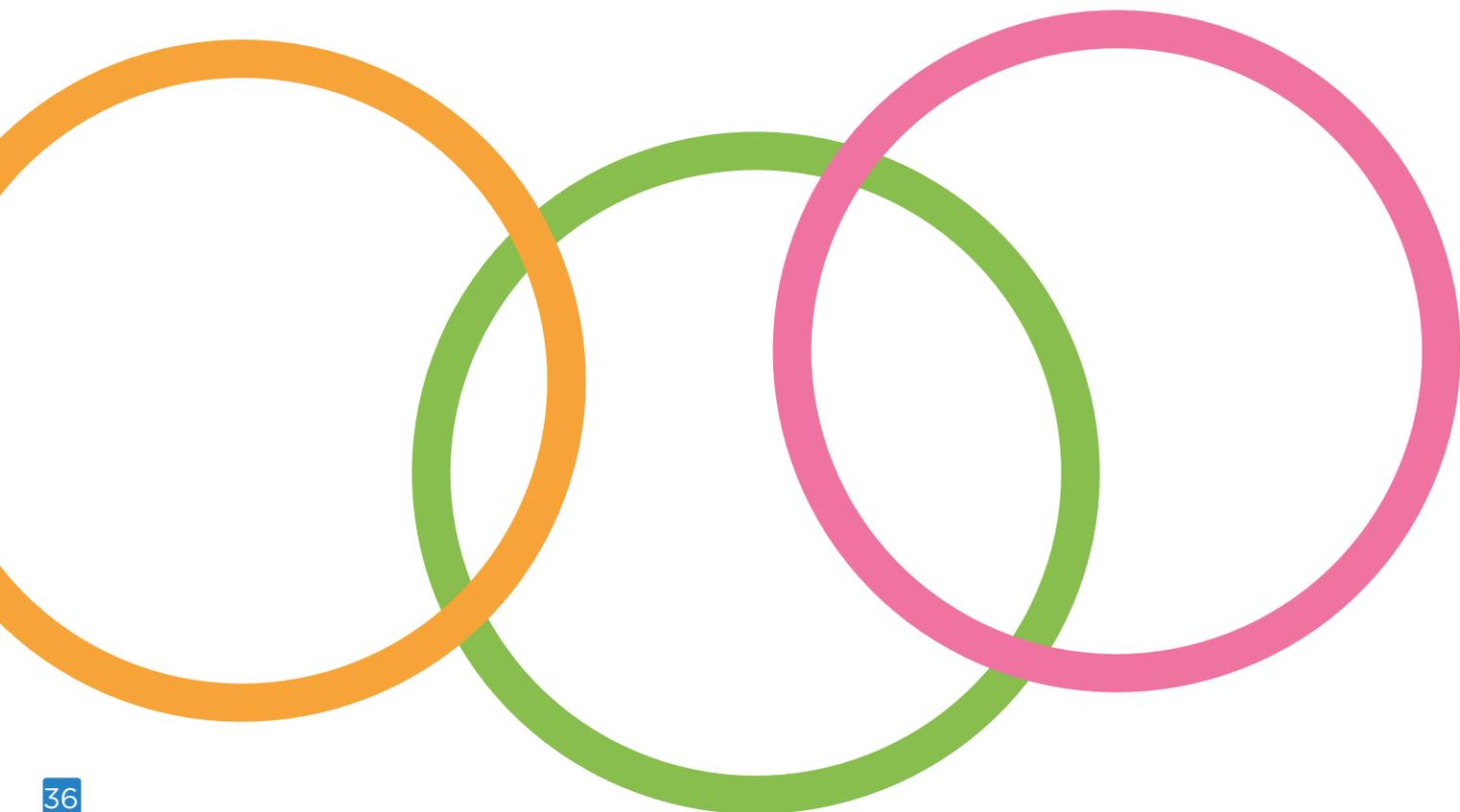
5 RECOMMENDATIONS AND NEXT STEPS

Over the past three years the HMHM programme in Scotland has scaled-up and spread from a low base to over 15,000 people with a variety of health conditions, using several technologies for different purposes. As previously discussed, this level of progress should be applauded, but it is also contended that the 12 partners involved have not yet been implementing HMHM long enough for it to be considered sufficiently scaled-up or spread to realise the level of benefit that our policy documents would like to achieve. **It is recommended that a target level of scale-up for HMHM be agreed within national policy** that is likely to realise the full potential of HMHM, plotted out at key time points into the future.

More time is needed to reach a tipping point where HMHM becomes business as usual. A wealth of expertise has been created across these 12 partnerships and ongoing national and local efforts are needed to ensure that this continues to be available, both at a local level and for others wishing to adopt any of the available technologies. The number of people whose outcomes have improved is not yet large enough to impact on Scotland's health profile. Our NHS boards and health and social care partnerships need to take up the challenge, on behalf of those who will benefit.

If it is accepted that scale-up, spread and sustainability have been affected by the level of complexity associated with HMHM in Scotland, there are two key recommendations. Firstly, use of the Non-adoption or Abandonment of technology by individuals and difficulties achieving Scale-up, Spread and Sustainability (NASSS) framework for HMHM **(Table 11) should be reviewed and, in collaboration with TEC partners and experts, give consideration to how to to reduce the level of complexity of any domains that are currently 'complicated' or 'complex'.** The framework includes definitions of all three levels of complexity that can be used to facilitate discussion of what aspects of the programme would need to change for any domains to shift towards a 'simple' classification.

Secondly, it is recommended that **further consideration be given to the principles created by Greenhalgh et al (2018) to support an increase in the scale and pace of HMHM implementation**. The TEC Programme has been working on a number of these in recent years, so Table 12 has been constructed to help plan the way forward.

Table 12 – Principles to increase HMHM success applied to Scotland's experience to date

Greenhalgh et al (2018) principle	Comment on progress in Scotland
Assess the nature and extent of complexity in the programme and ensure that emergent and adaptive measures are used to address these issues	A first attempt at this has been undertaken in section 3.4 and this should be discussed further by people with a range of expertise
Establish overall leadership (since complex programmes often suffer from outsourcing of control and coordination)	National and Local Leadership has been in place for HMHM, but is at risk as without continued investment and prioritisation.
Craft and sustain a vision. Ensure that key players understand and share a sense of why the project is important	The vision exists in a range of policy documents and the published National Service Model but NHS boards and health and social care partnerships need to develop and adopt it locally
Create incentives, but leave front-line staff to work out how to deliver	Front-line staff now have a track record of working closely with TEC teams and this needs to continue as well as investing in workforce development
Respond adaptively as the programme evolves, for example, by collecting and reflecting on emerging data and harnessing human creativity	The national HMHM evaluation has been a valuable companion to inform progress, and continuing this would greatly inform its evolution and scale up
Control growth, since projects that evolve organically are vulnerable to over-ambitious extension and scope creep	HMHM funding responded to partnership interests but it may be helpful in future to focus on scaling up services and conditions that have been most successful/can offer most value
Create slack, to resource adaptive responses	Lessons have been learned about the level of human and financial resource investment required for HMHM adoption and funding should be targeted and increased
Manage the tension between innovation and implementation, especially when continuing evolution of the technology (e.g. additional functionality) adds to complexity	Scotland has developed a specification for procuring HMHM technology suited to our needs. This will not be an end point, but a staging post for evolution of the technology. Investment also continues with DHI and Next Generation Solutions

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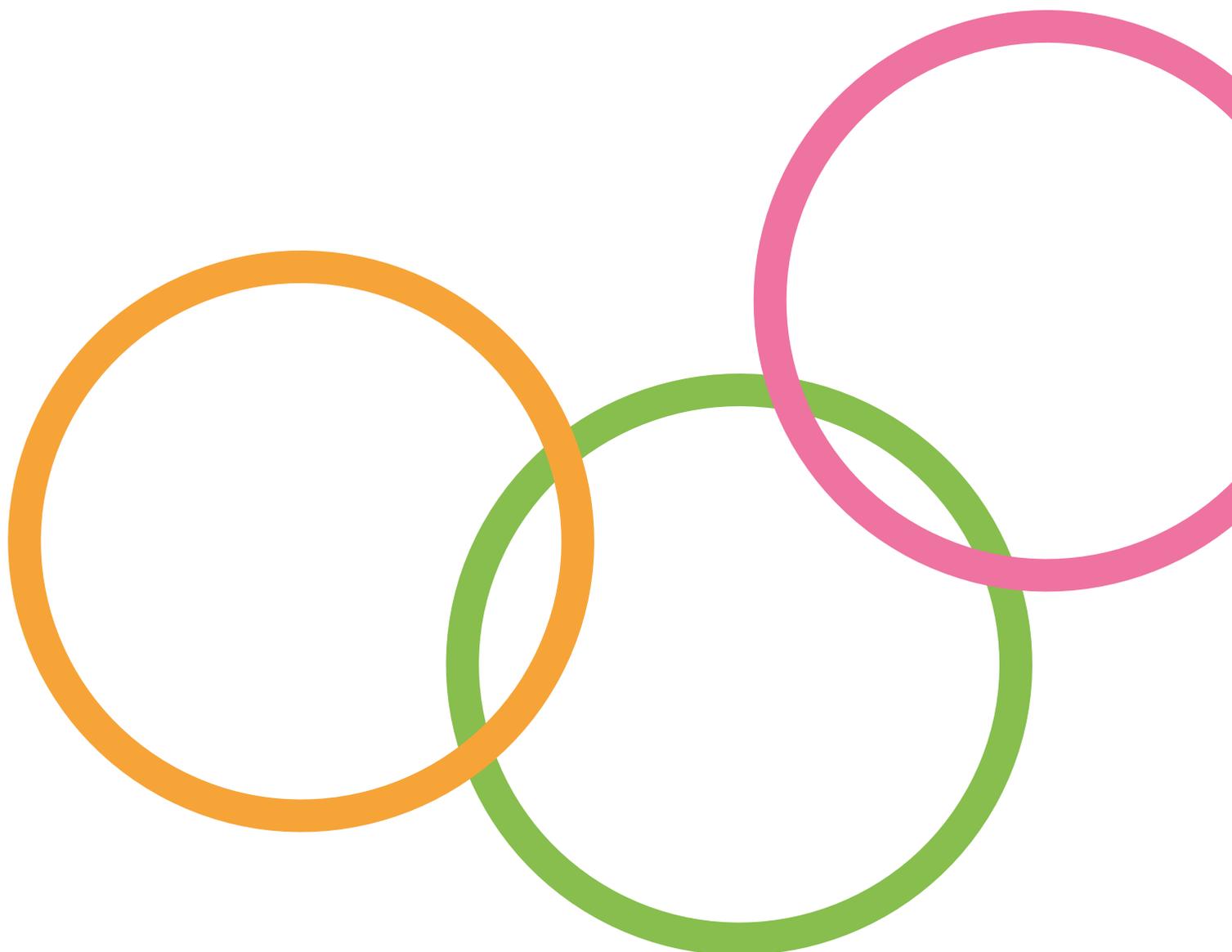
APPENDIX A – TEC PARTNERS' LEARNING JOURNEYS

A diverse group of partners was successful in securing awards from HMHM Programme funding. They were a mix of NHS Boards and Health & Social Care Partnerships, including those who were building on initial successes, altering course after Year 1, or coming on board during Year 2. There were partners who were able to recruit HMHM users at an early stage of their project and others who took a long time to overcome the obstacles they encountered. These differences are amongst the characteristics affecting progress and therefore ability to scale-up and spread, even with the considerable initial enthusiasm within each partnership.

Lessons can be learned from a brief description of the experience of all 12 partners. This is because they have faced different issues, not least in relation to their geographies (Figure 1). The following information is based on templates completed by each partner, covering key milestones, explanations for success and how challenges were resolved, if they were. It should be noted that the people involved are generally referred to as the 'TEC team' since they often have responsibilities for other TEC workstreams besides HMHM.

ARGYLL & BUTE HEALTH & SOCIAL CARE PARTNERSHIP

Argyll & Bute was one of the Year 1 partners who, once they had Caldicott approval in place, began to implement their HMHM plans one step at a time. Their initial engagement with General Practice worked well, as did building on good working relationships with their Dietetics department. Spread was also facilitated by their support for developing bespoke protocols for different services and being prepared to engage with each part of

their geographically dispersed teams. Key people included their supportive and engaged strategic lead, who kept TEC on the agenda at senior management level, and the dedicated TEC Programme Manager who ensured that all aspects of delivery were driven forward at the local level.

Some of the key lessons learned in Argyll & Bute have been that uptake increased when HMHM was presented as part of the service rather than an add-on option, that relationship building (or being already known and trusted) and/or having a champion on-board opened doors, and that the TEC team had to be accessible to service staff to tweak protocols and resolve any issues encountered. It has proved difficult to overcome the perception that HMHM was a project that would come to an end (so was not worth investing time in), lengthy recruitment processes for the TEC team, and clinicians not promoting use of their bespoke protocols (resulting in low uptake). Argyll & Bute's recognition in 2017 that their diverse geography (covering 2,600 square miles and 26 inhabited islands) meant they were not achieving their projected spread led to a rethink of the support needed and they now expect to reach their target number by the end of the HMHM programme.

NHS AYRSHIRE & ARRAN

Ayrshire & Arran was also one of the Year 1 partners and had previously participated in United for Health. One of their key milestones was the appointment of a Clinical Lead who was well-known to Primary Care colleagues. In addition to the original intensive monitoring home pods installed in people's homes, they adopted Florence text messaging and began using

their protocols for COPD, hypertension and mental health in the first half of 2017. They met their target numbers in advance of projected dates, have 40 of their GP practices using HMHM, and more than 90% of practices trained. Ayrshire & Arran took a different approach to TEC support by creating a single point of contact TEC Hub with specialist staff to support patients and GPs. This was done to take some of the burden of HMHM administration from GPs, but it also offered economies of scale that could be widened to other NHS Board areas.

Part of their success was due to having a Clinical Lead who was known and respected by other GPs, thus a highly credible advocate for HMHM. They also benefited from the outset in having a dedicated Senior Information Analyst who worked with the Clinical Lead to identify what needed to be measured and then set up all the data gathering processes. This was very helpful for evaluation both locally and nationally and local data has helped to promote HMHM with both staff and patients/service users. Data related to the impact on hospital services has been very persuasive with secondary care colleagues. Success also relied on the dedicated transformational TEC project team who not only assisted with all the start-up processes, but provided ongoing support.

Challenges in Ayrshire & Arran included not having sufficient finance to keep pace with the desired speed of HMHM scale-up or capacity to meet the level of interest from those wishing to be involved. It was also difficult to

overcome system constraints such as the slow response from providers to requests for changes to suit the logic model.

EAST RENFREWSHIRE HEALTH & SOCIAL CARE PARTNERSHIP

East Renfrewshire was successful in being awarded funding in Year 1, but its implementation plan was based on an anticipated staffing resource that was subsequently redirected to support major service change. They really began to make progress in Year 2 with recruitment of their HMHM nurse in April 2017. She was able to engage directly with General Practices and facilitate the first one going live within five months. As word spread about the benefits of remote blood pressure monitoring, momentum built for the next five months, when the 100th patient was recruited. They feel that buy-in from their Clinical Director was also critical to their success, and they ensured his positive attitude had a solid foundation by providing him with regular progress updates.

Key learning for East Renfrewshire included how accessing an existing network of contacts smoothed progress with equipment procurement. They found that respecting the practices' responsibility for record-keeping ensured data protection compliance, and that spreading positivity across General Practices meant that more patients could benefit from HMHM. Although they were very frustrated by thwarted early plans, they invested a lot of time and effort in their revised approach, challenging procurement obstacles, and minimising the time commitment required of practice staff. Their success has been rewarded with additional test of change funding to support further progress.

GLASGOW CITY HEALTH & SOCIAL CARE PARTNERSHIP

Glasgow City was a Year 2 partner and began by identifying target groups for HMHM. Their purchase of Florence at the start of 2017 coincided with an approach from the West of Scotland neonatal team to explore HMHM for new parents taking babies home after a prolonged period in

hospital. This became the focus after initial plans to support people with COPD had fallen through due to key staff moving on. Progress has relied on two members of staff, who took on HMHM in addition to their existing responsibilities. They continued to engage with GPs as best they could and since the first one went live in the summer of 2017 there has been an increased appetite for participation.

Although success has been somewhat limited due to lack of capacity to drive progress, the two members of staff have consistently reinforced the benefits whenever possible and supported staff to use HMHM. The initial enthusiasm of the neonatal unit staff was an important factor, but engaging parents to access the information/advice/peer support available via HMHM proved more difficult. This protocol has now been reviewed and relaunched and they hope it will be more successful in future. Glasgow City benefited from word of mouth recommendations on the value of HMHM, but now recognises that more systematic approaches are needed. They recognised some time ago that they needed dedicated HMHM support and have endeavoured to recruit someone. Several unsuccessful options further delayed progress, but they hope that their current solution will be effective.

NHS HIGHLAND

Highland secured Year 1 funding and initially focused on a tablet-based intensive telehealth system installed in the homes of people with COPD and heart failure. Patients liked its ease of use and being able to see their data in graphs, however, it was a relatively expensive system, required equipment delivery and installation to be co- ordinated, and the specialist nurses found logging-in to check for alerts time-consuming. Having been trained to use Florence text messaging around the same time, NHS Highland decided to focus on this more cost-effective option. Highland invested in evaluating their

HMHM work, both commissioning an external evaluation from the University of Edinburgh, and internally within the TEC team, both of which generated positive results. The latter included the production of evaluation tables for each Florence protocol which created a useful summary of progress for this national evaluation. Highland also generously shared some of its evaluation materials with other partners, notably their patient experience questionnaire.

The Highland TEC team attributed much of its success to widespread awareness-raising and engagement across its considerable geographic area. By responding to approaches from many different committed and innovative clinicians, they developed the largest number of Florence protocols of all the HMHM partners (n=60). Some of these successfully supported more than 100 patients whilst others steadily built up numbers as clinicians became increasingly convinced of the benefits. A number of protocols were used by very small numbers, although they continue to be helpful e.g. one person was discharged three days earlier from hospital than they would otherwise have been. Highland also converted some validated questionnaires onto Florence at the request of clinicians, but these largely failed to yield the expected release of clinic time, because they were not fully completed or it was clunky to access the results. They have more recently had success working with eHealth colleagues to create an interactive asthma report, available to clinicians via SCI-store, and hope to extend this to other conditions in the near future.

Some of the challenges encountered in Highland were due to the time required to cover their entire geography, but this also meant that dispersed clinical teams did not always feel ownership of the protocols developed by their colleagues. Some clinicians enrolled higher numbers of people onto Florence than others, which may in part be due to how enthusiastically

they presented HMHM to their patients. Some with lower enrolment numbers attributed this to their patients' age or poor mobile phone signals; the latter can be a problem, but others did not consider it prohibitive. The Highland team also felt that some senior clinicians remained unconvinced of the evidence base for telehealth, particularly when some of what was published relied on qualitative data. However, given the fast moving nature of technology development, some of the evidence (for costs in particular) quickly dates.

NHS LANARKSHIRE

Lanarkshire was one of the first partners to recruit patients onto Florence, as they were ready to begin recruitment as soon as they received their Year 1 funding. They were delighted with their first positive feedback from a patient and with the Practice Nurse peer learning observed at an education event on the benefits of using Florence within General Practice. Lanarkshire capitalised on its existing contacts/ networks to best advantage to exceed its GP rapid improvement study recruitment targets in Primary Care. The team's willingness to share early experience and then expertise/resources across Scotland and beyond earned them a reputation as the go-to people for implementing Florence. Recognition of their success led to awards and accolades, as well as enthusiastic applicants for what were initially only temporary posts (they have now been made substantive).

Lanarkshire attributed some of its success to clinical buy-in from those who recognised the gap that HMHM could fill, and prepared to devote the time to get the process right. They also benefited from enthusiastic local communications support that ensured their progress maintained a high profile in the media, and data analysis & evaluation support to help show what difference HMHM was making. They worked closely with their

procurement manager to secure the best price for blood pressure monitors and went on to share this experience with other partners. But perhaps their most critical move was the creation of a TEC team that worked together to resolve any challenges and supported one another in their joint learning. Whilst the team has needed lots of patience, they have also developed in line with new responsibilities and ensured they can cross-cover for each other to cope with the considerable demands on their time.

Lanarkshire did at times find staff attitudes towards the use of HMHM challenging, particularly when the team was perceived as IT experts. This was countered with lots of reassurance that a high level of knowledge was not needed to use Florence since the team had started without this. An early lesson emerged from the recognition that staff not involved in developing Florence protocols were not keen on using them, so the team now ensures full involvement from the outset. They have found it more difficult to work around issues with HMHM systems, since these are not within their own control. For example, the Florence provider has been unable to respond to change requests for additional functionality as quickly as Lanarkshire would have liked and Diasend reports can be problematic. However, the team endeavour to turn system limitations to their advantage by suggesting that the simpler things are, the better for clinicians.

NHS LOTHIAN

Lothian was also a Year 1 partner and used its funding to scale-up remote blood pressure monitoring across its board area. Having a clinical lead who was also a local General Practitioner meant that approaches to other practices could be based on a sound knowledge of local GP need, and worded in a way likely to succeed. An early win was the speed with which practices responded to the first invitation to become involved, which contributed to the first

patient being recruited within four months. Lothian's work has attracted much attention, including from the Cabinet Secretary for Health and Wellbeing, and their 1,000 patient milestone was reached before the end of HMHM Year 2.

Lothian's scale-up was externally evaluated by a team from the University of Edinburgh and Napier University with funding from the Chief Scientist's Office and the final report is due for publication in the near future. Amongst the reasons for their success, Lothian identified the role of local champions who spread the word about HMHM benefits and encouraged further implementation, along with having a number of early adopter practices to iron out teething problems. They were also determined to ensure that the Telehealth system was integrated into normal practice and they worked well with eHealth colleagues to develop reports with patient HMHM results that could be accessed directly from the GP IT system. And early-on they held a successful patient information evening that meant they had a high level of recruitment from a single event.

Lothian encountered some perception problems that needed to be challenged along the way, including staff who thought that IT was necessarily complex. This resolved with improved training and the provision of a helpline to access rapid support. There was also a perception that HMHM increased workload. While this can be the case initially, Lothian found that good training and increased use led to a decrease in workload, and they intend to publish their evidence that HMHM has saved face-to-face appointment time for practice staff. There was a time-limited challenge when an IT update stopped Florence from working. This was resolved, although it took some months to work through with eHealth.

MIDLOTHIAN HEALTH & SOCIAL CARE PARTNERSHIP

Midlothian secured funding in the second year of the HMHM programme to support a redesign of the dietetic malnutrition care pathway where Oral Nutritional Supplements (ONS) were often prescribed but not always used. They decided that telephone keypad technology would suit their mainly elderly patient group as it was already familiar to them. People engaged with the HMHM system to respond to questions and input information such as their weight. They managed to overcome a number of challenges and enrolled their first patient in May 2017.

The process of implementing Midlothian's plans revealed a considerable amount of work that was a prerequisite to going live. This mainly involved securing the support of a very busy eHealth team, whose other work was continually prioritised over HMHM. The Project Manager carried out a review of system-wide readiness for HMHM in his Master's thesis and found it was not as high as originally thought. However, they persevered and now have a renewed commitment that will enable them to deliver efficiencies. Lack of eHealth input did not prevent HMHM implementation, but it affected Midlothian achieving all the planned outcomes.

TAYSIDE HEALTH & SOCIAL CARE PARTNERSHIP

Tayside was funded in Year 2 to implement five Florence protocols (oral nutritional supplements, weight management, hypertension, smoking cessation for pregnant women, heart failure). They began to make progress with enrolment after finding a clinical champion for weight management and watched numbers grow steadily at first and then at an increased rate as she inspired her colleagues as well. And a snowball effect appears to have started through General Practitioner word of mouth, which it is hoped will increase

hypertension recruitment in future. Having strategic support locally and a dedicated TEC Programme Manager were critical to Tayside's success, as was being able to share evidence of the benefits with key individuals to encourage them to use Florence. However, the simplicity of Florence that supports spread was also found to be a challenge because it was unable to be integrated into routine patient care systems. Whilst one very IT literate Cardiologist in Tayside was able to develop a way of downloading the data from Florence into the cardiology database, a solution that enabled this across all the protocols was needed across other services.

Whilst Tayside had a champion for one protocol, they encountered some challenges in rolling it out to other colleagues. The dispersed teams across different areas were found not to be fully engaged so they will soon be provided with an opportunity to learn more and benefit from HMHM training. GPs were not fully on board at first, partly because Florence does not link to their IT systems, but there also appeared to be a degree of reluctance to hand over responsibility for blood pressure monitoring to their patients. Some worried that a reading might be missed that could lead to harm if not acted upon. Despite the challenges, Tayside feel strongly that HMHM could be transformational if it was embedded into existing systems, allowing accessing the data generated and becoming the new way of doing things.

WEST DUNBARTONSHIRE HEALTH & SOCIAL CARE PARTNERSHIP

West Dunbartonshire was awarded Year 2 funding to support people with COPD to identify early signs they were becoming unwell and implement an agreed self-management plan. They also offered combined teleheath (HMHM) and telecare via a community alarm, which was to allow additional support from the community response team, if required. To support frail people to maintain their independence at home for as long as possible, they offered them an enhanced assessment kit. Their first person with COPD was enrolled onto Florence at the start of 2017 and frailty recruitment began a month later. West Dunbartonshire had a few issues to resolve, but once the Florence protocols were fully functional they found their COPD patients became more confident using their rescue medications without direct input from staff. They succeeded in engaging more staff via ongoing information sessions, updates on progress and visiting a number of sites.

West Dunbartonshire found that the initial cohort they hoped would use Florence was not well-engaged with the usual COPD service, so they had to change their criteria to increase numbers. However, their participants then included more young people, who felt they were not old enough for a community alarm. This resulted in good uptake of Florence, but not of the associated telecare. The team continued to engage with staff and share success stories to encourage them to keep promoting the benefits of the technology. This has sparked wider interest from different colleagues who can see the advantages for their own client group.

NHS WESTERN ISLES

Western Isles was funded in Year 1 and managed to go live quickly. Being amenable to try anything that made health monitoring easier for patients and staff led to them testing a wide variety of technologies, occasionally with just one person. The diversity of their approach was recognised internationally e.g. at the Veterans Administration in the USA and being invited to give a keynote talk in New Zealand. The commitment and skill of their TEC Project Manager was also recognised locally and his post has now been made permanent.

Part of Western Isles' success was due to having well-engaged clinicians, but also being able to demonstrate impressive clinical results (e.g. with the unique combination of Sensor Augmented Insulin Pump Therapy (SAIPT) and Continuous Glucose Monitoring (CGM) for people with diabetes). Their commitment to share success through on- line video evidence was also important for scale-up. The drive to keep things as simple and inexpensive as possible removed a lot of barriers to scalability, as did clinician buy-in when they saw clear benefits for patients/service users.

There have also been challenges in Western Isles, not least the initial perception from senior management that HMHM was just another pilot project. This was understandable in the early days when everything was new, but it has made it difficult to garner support for ongoing funding for some technologies. At times clinicians have found it difficult to free time from their busy workloads, but TEC team perseverance and a focus on the positives overcame most reservations. Western Isles did not manage to engage a GP champion, but has adopted a different approach now that will hopefully be more successful. And there have been contrasting levels of enthusiasm from patients e.g. some people with diabetes were reluctant whilst those with heart failure wanted all the help they could get.

WEST LOTHIAN HEALTH & SOCIAL CARE PARTNERSHIP

West Lothian were funded in Year 1 but began to overcome a number of obstacles with the appointment of dedicated HMHM support. Although GPs in West Lothian did not initially appreciate the potential benefits of HMHM, some of the early detractors have since become the

strongest advocates. This may partly be explained by the TEC team starting with simple protocols to encourage familiarity with the technology and building in more complication once this was achieved. However, such are the pressures in Primary Care that some practices remain unconvinced.

Some of West Lothian's success can be attributed to the dedicated HMHM Support Officer and the reassurance, point of contact and ongoing support they provide. The energy and ambition of the whole West Lothian TEC team has contributed to the positive feedback they have received from service users, many of whom relate to Florence as if it was a real person. West Lothian intentionally created a culture of co-operation and co-ordination through an integrated TEC Board and found that aligning a number of strategic plans (including the Primary Care Development Plan) to TEC developments helped to increase HMHM uptake over time.

Not least amongst the challenges to be overcome was the initial lack of appetite for HMHM in Primary Care, but in addition to minimising the disruption to usual working practices, West Lothian offered ongoing support until the new processes became routine. Staff turnover in the TEC team was problematic at times, but understandable when only short-term contracts were available. Some of the other challenges faced became learning opportunities e.g. for a Health & Social Care Partnership to navigate complicated equipment purchases through NHS procurement systems, and to work out the different departments that needed to approve the implementation of new technologies. In spite of varied levels of technology literacy, West Lothian demonstrated how different HMHM solutions could be adapted across its population.
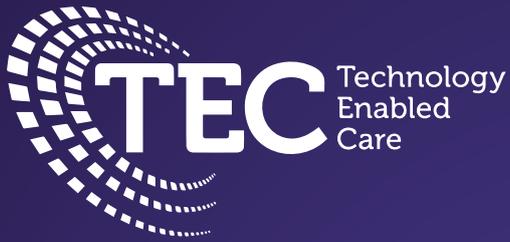
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