Service Evaluation of Three Telehealth Services for Monitoring Patients with Asthma, COPD, and Heart Failure
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Clarification note added by TEC team: This document includes the executive summary from Mairi Wolters Service Evaluation, plus selected paragraphs from the main body of the text and a few notes of clarification added by the TEC team.

1 Introduction

1.1 This report presents an evaluation of three families of telehealth services developed by NHS Highland that used Home and Mobile Health Monitoring (HMHM) to support people with asthma, Heart Failure, and Chronic Obstructive Pulmonary Disease (COPD) in managing their own illness. The NHS Highland Technology Enabled Care (TEC) team developed and deployed the services with funding from the Scottish Government’s Technology Enabled Care (TEC) programme. Services were evaluated against eight benchmarks that had been agreed for the TEC programme. Additional aspects not covered by these benchmarks that emerged in the evaluation are also highlighted.

1.2 The report builds on seven distinct data sources: the TEC Minimum Data Set, covering demographics and characteristics of the population; data generated by Motiva; data generated by Florence; interviews with clinicians, patients, and carers that were conducted by the evaluator; and three data sets compiled by NHS Highland, data on hospital outpatient and inpatient appointments, GP appointments, and prescriptions.

2 Evidence Towards the National HMHM Logic Model

2.1 There is positive evidence for all eight aspects of the HMHM logic model:

2.1.1 There are more HMHM enabled services: The three services analysed here did not exist before the TEC programme, but have now become part of standard practice for Tier 3 and 4 patients with COPD, Heart Failure, and Asthma, who are seeing specialist clinicians.

<table>
<thead>
<tr>
<th>Patients until Feb 2017</th>
<th>Asthma</th>
<th>COPD</th>
<th>Heart Failure</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Feb-June 2017</td>
<td>21</td>
<td>21</td>
<td>4</td>
<td>46</td>
</tr>
<tr>
<td>Total Patients</td>
<td>92</td>
<td>69</td>
<td>62</td>
<td>223</td>
</tr>
</tbody>
</table>

2.1.2 Patients are more aware of self-management: They adhere well to measurement protocols, and telehealth helps them recognise symptoms and better understand their condition.
33 (63%) of all 52 patients enrolled in the Heart Failure version responded to the evaluation survey that was presented after three months. For COPD, 32 (76%) of 42 patients responded. Results are summarised in Data Table 8.

2.1.3 Almost all patients agreed that telehealth had helped them understand their condition and recognise symptoms. Half the COPD patients and most heart failure patients felt that the readings had helped a lot. Half the COPD patients saw a real difference in their ability to recognise exacerbations, and half the heart failure patients felt that telehealth had substantially improved their ability to recognise decompensations.

2.1.4 Patients adhere to telehealth, which shows awareness of self-management, and actively use the data to gain insight into their condition and take medications, if necessary.

2.1.5 Increased % of population self-managing: Patients adhere well to symptom monitoring protocols, they know how to initiate appropriate action, and telehealth supports them in making better lifestyle choices.

The number of prescriptions per month increases after a telehealth system has been initiated for Flo.

![Number of Prescriptions Issued for COPD Patients](image)

Figure 2: Average number of prescriptions issued per month and per patient before and after starting telehealth for COPD.

There are several possible reasons for this. It is possible that patients are prescribed more medication because they are sicker. On the other hand, patients may have finally started taking their prescribed medications as prescribed, including rescue medication.
Clinicians had many stories that illustrated how patients were self-managing. CH reported a patient who had a critical reading, and had already acted on it by taking a diuretic by the time the nurse called.

People who are on telehealth seem to improve their ability to self-manage by taking the correct medications on time and by changing their lifestyle. Given the evidence discussed in the preceding sections, it is plausible that the increase in prescriptions is due to patients actually taking their medication as prescribed. It remains to be seen whether this persists once they have been discharged from telehealth.

2.1.6 Increase in condition control: Clinicians report better symptom control for many patients whose control was previously poor, and patients feel more in control. This may not necessarily translate into better scores on symptom questionnaires.

2.1.7 Clinical team response: Clinicians actively use telehealth in their practice, and patients feel that the telehealth service works well in connecting them to appropriate care.

To patients, telehealth means that they are connected to their clinicians, regardless of the distance they need to travel in order to attend clinics at Raigmore. Patients see how telehealth affects clinicians’ decision making, for example during medication reviews (P2a, Heart Failure), and appreciate being able to see their charts during consultations (P6a, asthma). Patients know that the readings they submit matter, and this could be the reason for the good adherence we have seen.

High adherence also implies that clinicians have enough data to see patterns in the readings provided, and it is easy to check in on patients without having to contact them in person. In particular, the data make it a lot easier to fine-tune medications.

Clinicians also appreciate being alerted when patients cross a critical boundary in their self-reported measures. The telehealth systems are set up to remind patients of the appropriate actions to be taken in these circumstances, and the clinician can follow up as required.

2.1.8 Access to Services: Despite clear infrastructure issues, telehealth is seen as greatly improving access to services in areas that need them.

Patients feel that telehealth brings them closer to clinicians. The effectiveness of the remote links, however, depend greatly on the infrastructure. Florence relies on a good mobile signal, which is not available for many of the patients interviewed.
Clinicians found that telehealth made it a lot easier to check up on patients without having to rely on home visits or trips to GP practices in remote areas. In particular with Florence, relevant data are pushed to the clinicians.

### 2.1.9 Hospital Admissions:

Although the number of patients is too small for statistically significant conclusions, the evidence so far suggests that telehealth may reduce both the number of admissions and the number of bed days.

![Graph showing number of inpatient admissions grouped by condition before and after telehealth](image)

Figure 6: Number of Inpatient Appointments by Condition and Relevance

Figure 6 shows the number of admissions for all patients before and after initiating telehealth. The Figure shows both admissions involving a specialty that cover the three monitored conditions (relevant specialties), asthma, COPD, and Heart Failure, and admissions involving other, unrelated specialties. After patients start telehealth, the number of admissions for relevant specialties decreases substantially more than the number of admissions for other specialties. Figure 6 also illustrates that patients in all three conditions face a significant load of comorbidities.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Before Telehealth</th>
<th>After Telehealth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>129</td>
<td>29</td>
</tr>
<tr>
<td>COPD</td>
<td>183</td>
<td>186 (80)</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>319</td>
<td>132</td>
</tr>
</tbody>
</table>

Table 14: Data Table 10: Total Number of Bed Days

<table>
<thead>
<tr>
<th>Condition</th>
<th>Before Telehealth</th>
<th>After Telehealth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>52</td>
<td>15</td>
</tr>
<tr>
<td>COPD</td>
<td>64</td>
<td>110</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>115</td>
<td>80</td>
</tr>
</tbody>
</table>

Table 15: Data Table 11: Average Number of Bed Days per Half Year

Data Table 10 shows the total number of bed days for all patients before and after they started telehealth, while Data Table 11 shows the average number of bed days per half year. The data suggest that bed days were reduced substantially for asthma. We also see a reduction for heart failure, albeit not as pronounced.
There is no difference for COPD, but this is mostly due to one particular patient, who was hospitalised for 106 days for a COPD related condition after the date they started on Motiva.

Clarification note added by TEC team: The patient who was in hospital for 106 days is known to the specialist respiratory nurses and the length of his stay “wasn’t due to COPD, but changing home and social circumstances).” Indeed, he “he only used Motiva for 2 days but wasn’t disenrolled”. Hence, the inclusion of his 106 day stay inappropriately distorts the data.

2.1.10 Optimised Face to Face Contacts: Telehealth increases the quality of face-to-face consultations with the specialist nurses. There may be a reduction in GP contacts, and preliminary data show no reduction in outpatient appointments.

![Total Number of Outpatient Appointments, Grouped By Condition](image)

**Figure 7: Number of Outpatient Appointments by Condition and Relevance**

**Outpatient Appointments** - Unlike for hospital admissions, we see no reduction in the number of appointments that relate to the condition being monitored. This can have several reasons, such as an overall shift of patient contacts from hospital admissions to outpatient appointments, or a few patients who attend more regularly.

Clarification notes added by TEC team: the specialist respiratory nurse is clear that the number of outpatient appointments she has with many of her patients has fallen, and that the increase in outpatient appointments shown in the data is a result of Florence being used with difficult asthma patients on biologic medication, who need to be seen regularly.

Note also that the number of outpatient appointments for COPD patients does show a fall in Figure 7.

2.1.11 GP Appointments – the data show, the frequency of condition related appointments declines while patients use the telehealth service. Most of this decline appears to stem from a reduction in face to face appointments at the surgery.

Clarification note added by TEC team: the following table shows the average figures for all patients.

<table>
<thead>
<tr>
<th>Condition</th>
<th>All consultations – average per patient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
</tr>
<tr>
<td>COPD (4 patients)</td>
<td>2.65</td>
</tr>
<tr>
<td>Heart Failure (2 patients)</td>
<td>0.15</td>
</tr>
<tr>
<td>Asthma (9 patients)</td>
<td>0.67</td>
</tr>
</tbody>
</table>
3 Realist evaluation

3.1 A reanalysis of the evidence from a realist evaluation perspective suggests that telehealth as implemented here works because telehealth creates an effective link between patients and clinicians despite great distances. This allows patients to feel heard and looked after, and clinicians to get an up to date, accurate picture of their patients’ condition, which facilitates better clinical decisions. While telehealth does lead to more and better self-management, it remains to be seen whether the effect can be replicated without a trusted clinician in the loop. Well implemented telehealth also benefits carers, who are often neglected in the design of telehealth solutions, primarily by providing much needed reassurance.

3.2 While current Florence-based services work well, those services lack a key ingredient that patients and carers valued with Motiva, namely access to graphs of their own data. Further services should also adopt a more holistic approach, since many chronic illnesses are comorbid. One or two texts and measurements a day for one service do not represent a great burden; five or six for three different services do.