Innovating for Improvement

PROMPT – The Perioperative Remote Monitoring of Patients: a Pilot study

Imperial College Healthcare NHS Trust

Project led by: Krishna Moorthy, Venetia Wynter-Blyth, Maria Halley

The Health Foundation

Contents

About the project

- **Project led by the PREPARE for Surgery team at Imperial College Healthcare NHS Trust**

- A pilot study

- Focused on improving the perioperative pathway for oesophago-gastric cancer patients in the PREPARE programme

- Involved the implementation of a digital health platform specifically tailored to the patient group with the aim of increasing patient engagement

Part 1: Abstract

PROMPT was an initiative involving the development and implementation of an e-health platform to integrate services and coordinate care throughout the perioperative pathway for oesophago-gastric (OG) cancer patients. The intention was to complement our existing perioperative programme of support (PREPARE) by providing a real-time interface between patients and clinicians. This would enable us to robustly monitor physical fitness, nutritional status and psychological wellbeing before and after surgery as well as enhance patient engagement and supported self-management.

The intervention comprised of a digital platform designed to facilitate home remote monitoring (HRM) and supported self-management. The platform was developed in collaboration with patients and provided patient information, personalised goals and visual feedback for tracking progress. It also enabled contact with the team, recording of daily activities and integration with HRM devices to monitor adherence to goals.

The concept of the platform was well received by patients and initial uptake was promising. Patients reported it had the potential to empower and motivate them, with many finding the information useful and the link to the clinical team comforting. Challenges included a complex platform architecture that was not intuitive to use, software problems and time constraints hindering adequate initial patient training.

As a result, overall adherence to the platform use was somewhat compromised. However, this programme has provided an excellent learning opportunity and a solid foundation to develop and refine the platform going forth.

Part 2: Progress and outcomes

The intervention

Surgery can no longer be perceived as a stand-alone intervention; the before and after period must be given equal attention if we are to improve post-operative outcomes. Most of the perioperative pathway extends into people's homes and we have found the missing element to be the ability to robustly monitor patients' physiological, nutritional and psychological status. The aim of the PROMPT (Perioperative RemOte Monitoring of PatienTs) project was to provide a technology-enabled specialist 'hub' to integrate services and coordinate care across boundaries and throughout the perioperative pathway.

We wanted to provide a real-time interface between the patient and clinician using home remote monitoring (HRM) with predetermined parameters to detect clinical signs of deterioration and progress. We hoped that our intervention tool would help promote patient engagement in the PREPARE programme.
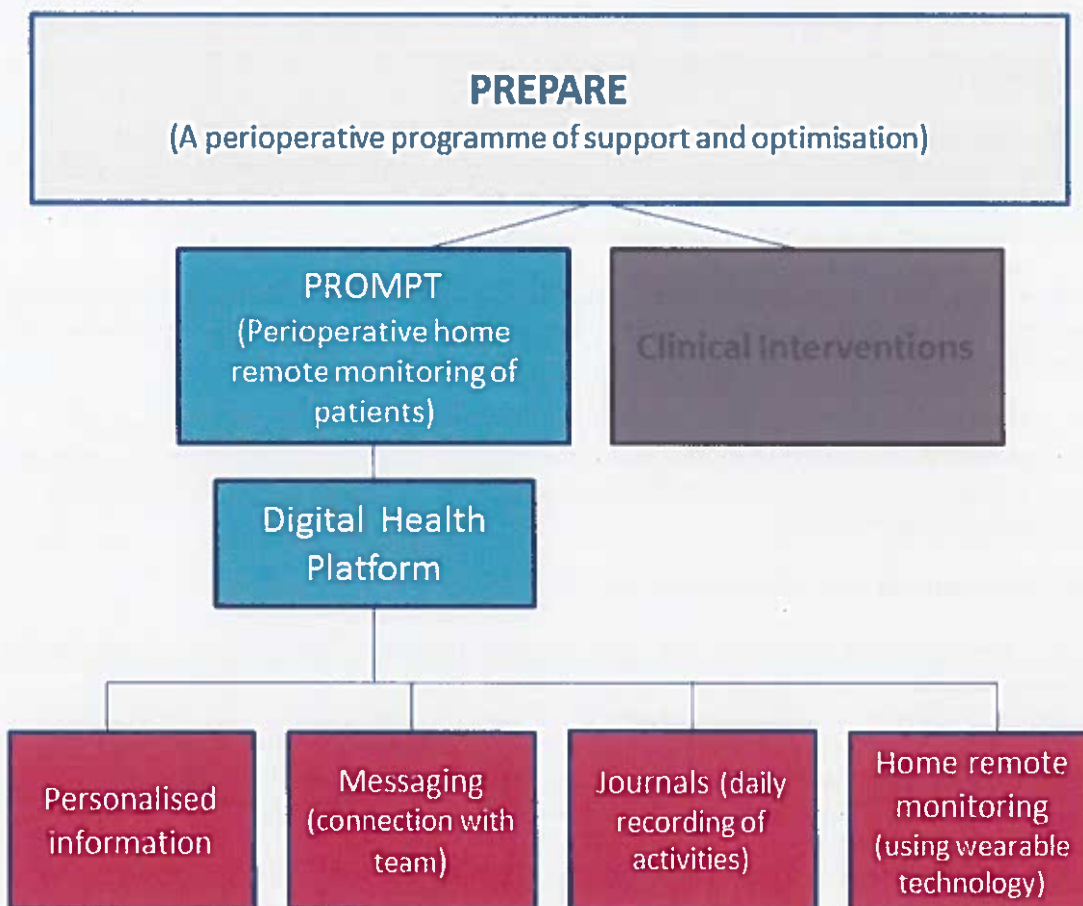
PROMPT is the technology arm of the PREPARE programme and works in parallel to the clinical interventions.

PROMPT was to include two distinct elements:

1. A digital health platform with an integrated functionality to connect Bluetooth-enabled HRM devices including wireless activity trackers, weighing scales and finger probe pulse oximeters to monitor agreed health parameters.

2. A responsive specialist outreach service intended to react to clinical triggers through virtual consultations, home visits and contact with community-based professionals to minimise hospital admissions.

A part-time project practitioner was hired to support the coordination of PROMPT and HRM of patients. We were unable to negotiate a community liaison contact to facilitate our specialist outreach service and therefore agreed to shift the focus of the project from responding to clinical signs of patient deterioration to engaging and empowering patients to take control.

Data and monitoring plan

We modified the evaluation plan to what we found to be most practical and achievable. In order to monitor the impact of the project on outcomes we decided to measure the following:

a. **App usage** through data analytics (Appendix.1a)

   Data analytics were provided by our app developers after each quarter. These provided information on the frequency of individual connections to the app and the volume of connections for each section e.g. 'physical activity', 'respiratory', 'eat well', 'psychological', 'ask about medications', 'remove bad habits' and 'enhanced recovery'.

b. **Patient acceptance of the technology and perceived usability after receiving initial training** through TAM 1 and UMUX-Lite 'usability' surveys (Appendix.1b) pushed through to the user at the time of registration.

   The TAM questionnaire produces a score out of 100 for six individual factors associated with acceptance of the technology (performance, effort, attitude, social, facilitating conditions, anxiety in use and behavioural intention). UMUX-Lite also produces a score out of 100 and measures satisfaction with technology.

c. **Patient experience** through semi-structured interviews (Appendix.1c).

   Patient interviews were held at two time points to gather feedback relating to their experience and perspectives after using the platform; after the initial six month period of giving the platform without HRM devices, and following the addition of the HRM element (second 6 month period). Patients' responses were transcribed to produce narrative summaries A staff focus group was held separately after phase one to gather further feedback and thoughts. Key themes were drawn from the responses to best summarise the successes and failures of the app.

   All day-to-day issues and feedback comments were captured on a dedicated PROMPT storyboard (Appendix.1d). Problems which significantly affected patients' ability to use the app were fed back as 'urgent' to the app developers for the purpose of resolving; otherwise the architecture of the app was left in its original format.

Impact of the project

Between March 2017 and 2018, 34 patients agreed to be registered on the app (table below).

Demographic data for user group		
34 users	Age	Average: 63years (Range 30- 82years)
	Sex	77% Male
	Language	82% Fluent English speakers
	App users	77% previous app users
	Tumour type	59% Oesophageal 38% Gastric 3% non-cancer
	Carer support with app	44% required help from carers to use app
	Anxiety score	Median: 6 Average: 6.9 Range: 0-19
	Depression score	Median: 5 Average: 5.4 Range: 0-16

Quantitative results

1. *Data analytics*

While overall uptake of the platform was impressive, adherence and sustained use was low.

- 75% of the 45 patients offered the platform agreed to take it on.

- The highest number of user connections to the platform was 65 and the lowest was 0.

- Just 29% of users made >20 connections (graph below).

- 65% made <10 connections.

The most popular sections overall were 'nutrition', 'physical activity and 'enhanced recovery'.

- 56% completed the 'eat well' journal (1-37 times).

- 41% completed the 'exercise' journal (1- 68 times).

- 38% viewed the section on Enhanced Recovery.

- 19% viewed the psychological wellbeing section.

% Users v. Frequency of app connections
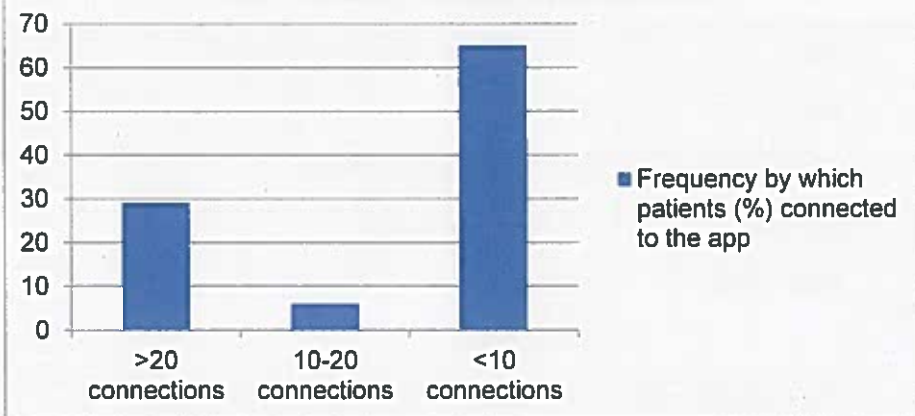
We also found through looking at correlations between patient demographics (age, sex, previous app use, anxiety, depression scores, tumour type, language) and connections to the platform using Chi-Square analysis, that those who had previously used apps connected more frequently than those who hadn't ($p= 0.05$). Although higher anxiety and depression scores appeared to be negatively correlated to platform use, the relationship was not statistically significant ($p= 0.07$, $p= 0.09$). Age was not found to be a significant related factor ($p= 0.51$).

Connections to app Vs. Anxiety

$p = 0.09$ ($r = -0.287$)

Connections to app Vs. Depression

$p = 0.07 (r = -0.313)$
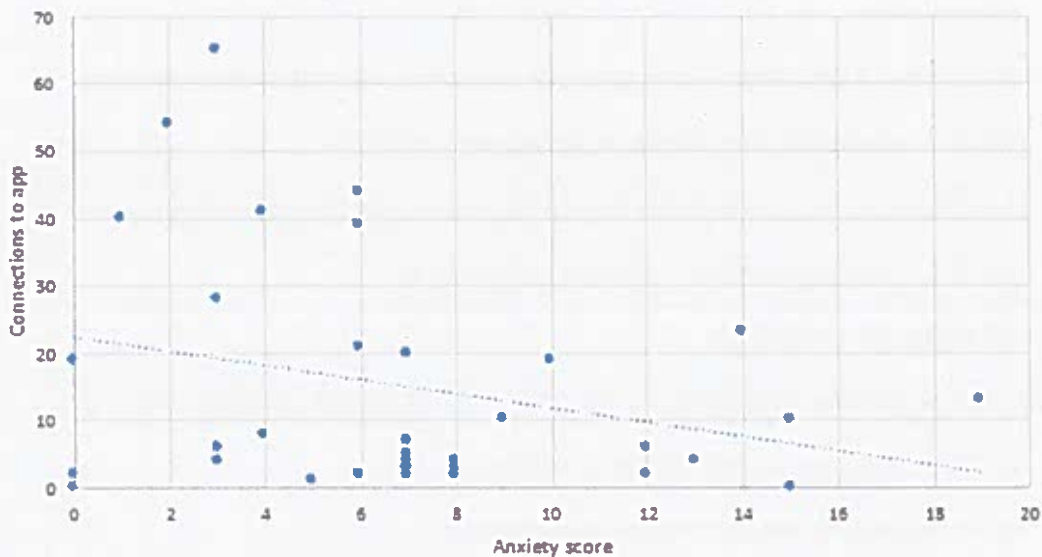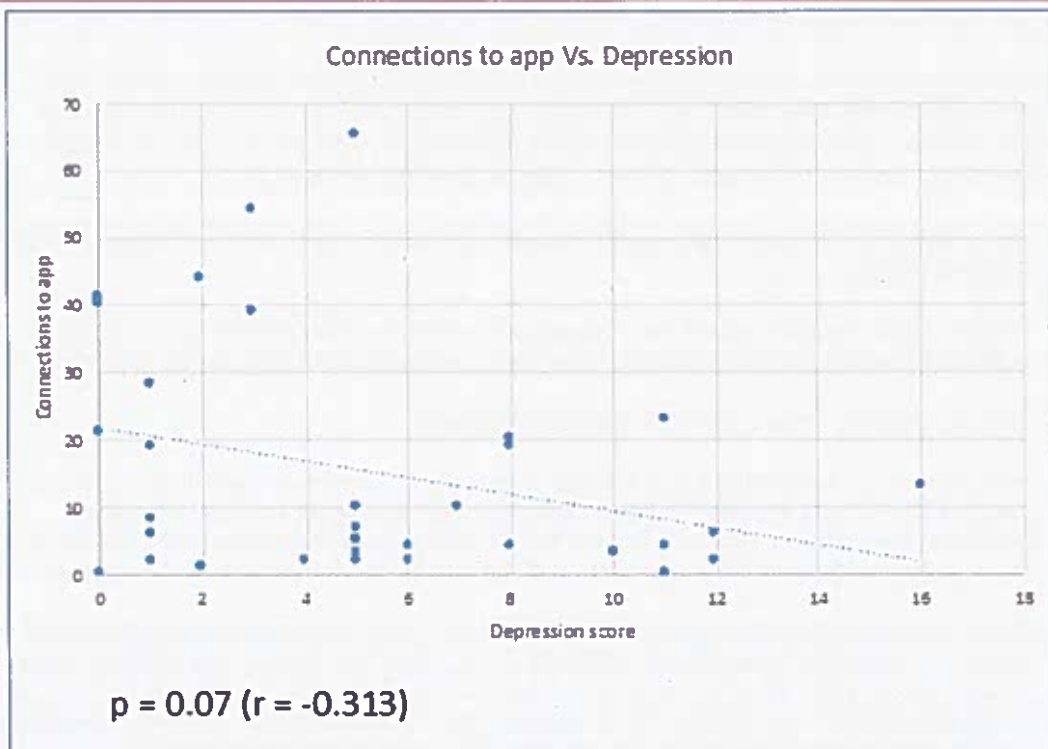
2. *Usability (TAM1 and UMEX-Lite)*

Following an initial training session on the platform, patients were asked to rate their initial perceptions prior to use. 29 patients responded to the survey. The response data is available in Appendix.1b.

Patients' perceptions in relation to factors of acceptance	Median (out of 100)	Mean (out of 100)
Attitude towards the technology	83	68
Impression of social influence of platform	83	72
Behavioural intention	83	74
Anxiety in use	33 **Range** 0-83	35

3. Semi-structured interviews

Eight questions were posed in structured one-to-one interviews to thirteen patients overall. Topic guides were agreed to ensure questions were mostly kept open. Questions ranged from general thoughts to feelings interacting with the technology to what they would change. Common themes extracted included 'delivery', 'concept', 'content', 'architecture' and 'technology'.

- An evident theme that emerged was on **delivery** and how patients felt they needed more time with initial training.

- Patients spoke positively about the **concept** of the platform; they alluded to how it had potential to be motivating and also how they enjoyed the connection to the clinical team.

- They consistently praised the information and **content.**

- In relation to the **architecture**, the majority of patients confirmed our own thoughts; it was complex and difficult to navigate, lacked flexibility and not reliable enough to replace traditional exercise adherence cards. 9 of the 13 patients (69%) interviewed alluded to the fact that the problems with the architecture of the app led to their reduced adherence and use.

- Finally, the **technology** itself posed many issues with even the most technologically-able patients. The platform was prone to software errors, difficulties logging in and the Bluetooth-enabled devices did not sync smoothly (or occasionally at all) with the platform. 100% of the 10 patients offered the HRM equipment reported problems syncing the devices and just two patients continued to sync the equipment manually to overcome this problem.

Theme	Patient responses
Delivery	"Didn't feel that setup was clear enough, needed more time."
Concept	"Brilliant in concept!" "It made me prepare to help myself." "Made me realise what you can do." "Felt like you are not alone".
Content	"Content was really good –" "... really helpful especially for family to know...." "Language is good – easily understandable as it's in layman's terms."
Architecture	"Need to make it simpler as difficult to use". "Not sure it's suitable as a whole. The capacity of exercise field could be enlarged." "Linkage between screens doesn't work very well."
Technology	"the issues I had made me give up". "Linkage between screens doesn't work very well" "The equipment wouldn't sync to the app itself"

Part 3: Cost impact

PROMPT was delivered as part of the overall PREPARE for Surgery programme. Therefore it is difficult to delink the costs and cost savings of the PROMPT project separately.

However, if PROMPT were to be replicated elsewhere we would estimate the costs of running the PROMPT programme to be

- Cost of a Band 6 clinician (nurse / dietitian/ physiotherapist) for training patients and responding to data/ messages from patients- £26, 565 (please check).

- Cost of 20 electronic tablets for the PREPARE digital health platform- £2,400

- Cost of the remote monitoring technology (20 packs)- £8,400 (each pack approx. £420)

- License fee for the platform (approx. £5000/ year)

Total= £42,365

While the cost savings of PROMPT cannot be calculated separately from PREPARE, we have estimated that the cost savings from the PREPARE programme are likely to be £200,000 per year based on costs savings from reduced complications and hospital stay.

An economic analysis undertaken for the PREPARE programme demonstrates a cost saving of £4000 per patient when the direct cost of care is taken into consideration. The average number of surgeries for OG cancer is 50 per year and thus the cost saving for our unit is in the region of £200,000.

It is unlikely that the platform, at this stage, has influenced any of the direct costs that we took into consideration during this economic analysis. It may have contributed to a reduction in hospital stay.

Part 4: Learning from your project

Reflection on outcomes

It is fair to say that what we achieved from the project was not what we had originally anticipated. We found that our initial expectations had been particularly ambitious for a single digital platform. Additionally, the platform lacked digital intuition and the technology did not always run smoothly. However, adherence was affected more by limitations with the architecture and problems with the software than acceptance and enthusiasm for the platform. This project provided us with invaluable insight into the technological capabilities and needs of people and carers affected by cancer. There is huge potential value in having a digital health platform that is personalised to patients in the cancer surgery setting to complement patient care going forth.

Enablers

The key enablers were:

Project champion:

A part-time project practitioner was responsible for coordinating the day-to-day running of PROMPT including patient introduction, registration, training, troubleshooting and liaising with the platform developers to optimise delivery. They facilitated the integration of PROMPT into the overall PREPARE programme.

PPI events:

Patient Engagement was a fundamental aspect of the development and evaluation of the platform and the project. The technology was developed using the principles of Co-Design, facilitated by experts from CLARHC NW London. This has not only contributed to the PROMPT project but has also contributed to significant insights on the targets for improvement and strategies for patient engagement in many aspects of our overall perioperative quality improvement efforts.

Stakeholder engagement:

Monthly MDT meetings focused on checking progress, addressing key issues and setting objectives against agreed timelines. Everyone actively contributed by reinforcing the idea of the platform during patient consultations. This inevitably played a key part in uptake and use.

QI methodology

We were also fortunate to have frequent support and contact from 'Haelo' to provide us with advice and enable us to meet our targets throughout the year.

Unexpected challenges and predicted risks

Challenges included:

Platform architecture:

The platform itself was difficult to navigate. It lacked flexibility and was subject to software issues affecting logging in, registration and email notifications, and HRM devices not syncing easily to the platform. This affected patients' confidence in the platform and thus overall compliance. In addition, due to proprietary technology platform source code constraints we were unable to fully utilise the patient feedback from the Patients as Partners events to make the appropriate changes to the platform architecture. We believe that this contributed to a large extent to the challenges experienced by the patients.

Time constraints

It could take over 60 minutes to register and train patients to use the platform. From the outset we anticipated that this might be a problem. In order to mitigate this issue it was agreed that patients would be called in advance of their appointment to introduce the platform and begin the registration process. This strategy did not prove to be effective however with patients often reporting feeling overwhelmed by their diagnosis and without having met the team there was little incentive to participate. Buy-in proved more successful when introduced in clinic after meeting the team therefore we adapted our protocol in line with this learning.

As it turned out, the time required was even greater than initially anticipated. As training took place at the end of clinic consultations, time available was limited and often varied between patients with some being allocated more time due to perceived need.

At the mid-point staff focus group, it was highlighted that the lack of standardisation in training meant some patients were given an unfair advantage by receiving more input compared to others. It was suggested we incorporate a digital tutorial into the platform to save on clinician time in patient training. It was agreed to go ahead with this key change as phase two of the project.

By the time the tutorial was developed and integrated into the platform however the programme was nearing an end.

Unexpected feedback

Over the course of the year it became evident that the overall compliance with the platform was low. It was surprising therefore to receive such positive feedback from patients in relation to the content available on the platform and the concept of the platform as a whole as a motivational tool. Patients specifically liked the messaging function and the idea of being connected to the clinical team.

Sustaining innovations in the NHS – Learning

Planning

- Prior to the development of any innovation, there needs to be careful planning and consideration of all information needed to meet the desired outcomes. Flaws at the planning stage could cost the project in terms of difficulties later on.

Cost

- The cost of developing a platform is likely to vary considerably depending on what features are needed. Given our high expectations for the platform in terms of functionality and outcomes, it's possible that had we invested more from the start in market research, patient events and platform design and development we may have had a smoother running platform.

Involving patients

- As a team, we know the value of involving patients in decisions regarding their future care and hold frequent patient events to gain insight into their perspectives. One learning point was that our initial platform prototype was tested on a very small patient group who were post-treatment and essentially 'well'. In hindsight, this sample group may have been a poor representation of the patients we would be offering the platform who were being treated with chemotherapy prior to surgery.

The overall impact of PROMPT was low in relation to our initial aims for integrating services and coordinating care throughout the perioperative pathway for OG cancer patients using HRM of patients, however there were many positives to be drawn from the project including the confirmation that the concept of having a personalised patient platform enabling contact with the clinical team is a good one with the potential for impacting motivation and engagement in a programme like PREPARE. We have learned a great deal and have taken away some key lessons which may enable us to provide a more efficient service for patients in the future.

Part 5: Sustainability and spread

Sustainability

There are a number of aspects of PROMPT that will be sustained beyond the funding period. These include:

HRM.

- As a result of funding from the Friends of Imperial College Charity we have developed PREPARE packs. Each pack contains an accelerometer to enable patients to track their progress and monitor adherence to the PREPARE programme.

Multi-modal patient information.

- Animated video content and pictorial representations were developed as an integral aspect of the digital platform. As an interim measure, and whilst we seek funding to modify the platform, we have created a dedicated website for patients to access these resources.

PPI events

- These have been an integral part of the PROMPT programme and we will continue to work alongside patients and carers in the future development of this programme.

Although the digital platform was not as responsive as initially anticipated it is clear from the uptake that patients like the concept and thus we will endeavour to source funding to modify and refine the technology accordingly.

Interest and recognition

We have received interest from a number of NHS Trusts and European Centres regarding this initiative. It is clear that there is a growing appetite amongst healthcare providers in technology as a tool to engage patients and facilitate supported self-management.

Selected awards and conferences include:

- *BMJ Surgical Team of the Year 2017*

- *BMJ Patient Partnership Award 2017*

- *NIHR CLAHRC NWL Brian Turley Award for Patient and Carer Involvement 2017*

- *Nomination for NHS70 Parliamentary Award for Excellence in Cancer Care 2018*

- *'Patient engagement in peri-operative pathways of care'. Keynote lecture, Zealand Surgical Forum, Copenhagen, January 2018*

- *'Improving outcomes in cancer surgery'. Keynote lecture, Landspitali University Hospital, Iceland, March 2018*

- *'Pre-operative optimisation and patient engagement in peri-operative care'. Clinical dilemma's in upper GI cancer treatment July 2017, Utrecht, Netherlands*

- *Working with people to sustain change: Incremental changes in OG cancer. Oral presentation. NIHR CLAHRC NWL Winter Event. 2017*

<u>Replicability:</u>

The learning and *know how* we have acquired over the past 18 months, as part of this programme, is a valuable resource to develop and replicate the intervention moving forwards. It can be divided into three key areas:

- Patient level

Dispelling myths and stereotypes:

Despite the demographic of OG cancer patients (typically older male) many liked the idea of the digital platform and the initial uptake was high. To patients it represented a solution to facilitate autonomy and control whilst to carers it was an opportunity to be involved in the care process.

It is evident that resistance to digital health solutions is a diminishing trend. However, initial uptake is only the start of the process. What is more important is the need to maintain and sustain engagement in the product. This can be achieved through user-friendly design (involving patients, carers and healthcare professionals), responsive technologies and stakeholder engagement.

Connectivity

The platform enabled patients to feel they *'were closer to the clinical team'*. The digital communication channel via a simple messaging function was an aspect that was particularly appealing to patients. It is important to note however that the platform did not replace clinical interactions but served to streamline patient-clinician interactions.

Motivational tool

The platform, and specifically the HRM aspect, was perceived by many to be a motivational tool. The ability to objectively chart progress and self-monitor, safe in the knowledge that their data can be viewed by the clinical team, enabled patients to actively participate in their care and thus influence their health outcomes.

- Healthcare professional level

The engagement and training of healthcare professionals cannot be underestimated to increase buy-in and endorsement. We found that as the confidence of the project practitioner grew over time in relation to the platform, how it worked and its overall value, so too did the confidence of patients. Particularly at the introduction and training stage where patients were given a choice to take on the platform, we found that the more confident we were in what we were introducing, the more likely patients were to get involved.

- Systems (technology) level

The core principles of PROMPT; HRM, multi-modal information and messaging functionality are transferable. We are collaborating with our Dutch partners (who have adopted PREPARE) to develop, modify (to context), implement and evaluate these specific aspects of the PROMPT programme.

There are plans in place to develop and refine the technology in response to patient feedback from the PPI events and learning from this programme.

Upcoming milestones:

In addition to submitting a manuscript for publication on the PROMPT programme; several spin off projects have been developed and include:

- A sleep study using HRM to explore how we can improve sleep hygiene of patients undergoing surgery for OG cancer surgery

- We will apply for European funding to work in collaboration with our Dutch partners to evaluate the impact of HRM on adherence to behaviour change as part of a surgical prehabilitation programme.

Appendix 1: Resources and appendices

Appendices:

a. Final data analytics report

b. Usability survey questions and scoring

- TAM1, UMUX-Lite

Usability data (results)

c. Topic guide for phase 1 and 2 and individual patient comments from semi-structured interviews

- Individual patient comments from semi-structured interviews for 4 elements of PROMPT (Information, Messaging, Journals, HRM)

d. Storyboard

Supplementary resources

- PROMPT timeline

- Flowchart of app distribution and uptake

- Dissertation based on Evaluating PROMPT