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The challenges of technology adoption in the NHS: lessons learnt from deploying PROMs collection devices

What are the challenges of designing and implementing technology to improve post-operative monitoring and treatment of patients?
Stating that using technology in the NHS to improve patient healthcare is difficult is old news, but why have we not made more progress in advancing digital health in practice? While there are considerable products and devices available, their use and (more importantly) their value in improving patient care and easing the burden on clinicians is not without its challenges. We report on some lessons learnt over the past seven years in deploying two patient-reported outcome measures (PROMs) collecting technologies and suggest ways to increase the chances of success.

**CASE STUDY 1: THE PAINPAD DEVICE**

Milton Keynes University Hospital and the Open University have a longstanding collaboration focused on designing and developing technology for adoption in the NHS. This emerged from the need to track patient progress in the six weeks following joint replacement surgery and before their follow-up clinic appointment (currently a black hole in our follow-up). The typical approach of asking patients to record their PROMs in paper diaries was rarely successful. These were infrequently returned and those that were appeared to be back-filled immediately before the clinic appointment. Even nurse-collected pain scores from the brief inpatient stay following surgery were incomplete as this was often not a priority on a busy, understaffed ward.

Our solution was to develop a simple handheld device to record pain scores. This was a cheap and simple box of electronics, named the PainPad (Figure 1), which beeped and flashed lights at the patient every two hours between 8am and 10pm to prompt them to enter a pain score using a visual analogue scale of 0–10.

Through iterative design with feedback from patients and the surgeon, this device was improved and eventually used in a human–computer interaction study. It showed that these data were collected more frequently than via nurses and that the data seemed to be more accurate. For example, patients often reported a lower pain score to the nurse than to the device, perhaps wanting to seem brave or not wanting to cause extra work. This study also showed that a handheld device worked better for older patients than a smartphone or tablet app. During the initial deployment of the PainPad, very few joint replacement patients had a smartphone because of the age demographic.

In developing the PainPad, we used iterative co-design to integrate feedback and requirements from both patients and surgeons. We also involved our hospital IT department early in the process and used the hospital’s open (no portal) public Wi-Fi network to send the timestamped data (patient hospital number and pain score, Figure 2 [anonymised]) to a secure university server. The longer-term plan is to have the data entered automatically into the electronic patient record along with any nurse-collected data.

The additional pain data that the PainPad provided also enabled us to make contributions to surgical practice. One example is that analysis of the pain data derived from the device showed no difference in pain after knee replacement with versus without tourniquet, with modern multimodal analgesia, lending evidence against old established practices.

However, we realised that our co-design strategy had not included important stakeholders. The nursing staff could not access the patient PROMs data so were not motivated to continue. Although the intervention initially involved the IT department, we did not regularly engage with them. When we were awarded NHSX funding...
to integrate the PainPad feed into the electronic patient record, we found it difficult to get the IT department to prioritise this component of the rollout.

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CASE STUDY 2: THE MYMOBILITY APP

Our second experience with technology for patient collection of PROMs was an app developed by Zimmer Biomet for elective knee and hip replacement surgery, called MyMobility. In contrast to our simple PainPad device, this app tried to cover the entire patient journey including videos of prehabilitation exercises, detailed lessons on expectations from the surgery, post-surgery exercises, automatic data collection of step counts and gait asymmetry, and a messaging system so patients could contact clinicians before and after surgery. The system also included an artificial intelligence component to analyse the data, providing clinicians with an early warning in the event that a patient’s recovery did not follow expected patterns. We interviewed five orthopaedic surgeons and physiotherapists to understand how the app was used.

Our analysis showed that the app suffered from a classic software engineering problem: feature creep. While the software was useful in highlighting specific and trend patient data within and among cohorts, it also introduced complexity and required increased clinician time to interpret the data screens, some of which were unused. The lack of integration into normal workflow practices meant that the data from the app were rarely seen by clinicians and patients.

Equally, the messaging system did not receive timely feedback. There was no direct communication per se via the app between patient and physiotherapist, causing delays and frustration. Furthermore, the physiotherapists had limited opportunities for input into patient rehabilitation as exercises were already prescribed within the system and physiotherapists were not able to change these according to patient needs.

On the plus side, it should be noted that patients are extremely positive about the video and education they receive on how to use the app and they very much appreciate being able to use the app to contact their clinical team. Moreover, the data generated are very useful for clinicians.

Interestingly, the commercial software engineers at Zimmer Biomet and the Open University research software engineers faced the same issues trying to get patient-collected PROMs data into hospital electronic patient records despite both projects providing funding to the hospital IT department.

LESSONS LEARNT

There is no one-size-fits-all solution in deploying technology across a broad patient and clinician demographic, and even if you think you have the right multidisciplinary team (including human factors experts), it is still possible to miss key stakeholders. In our case, both nurses and physiotherapists turned out to be the key enablers that were missed in each technology development. We are now involving nurses in the design of the ward dashboard to show the status of pain data over time for all the patients on the ward, highlighting those that are trending high. For MyMobility, we are recommending that physiotherapists receive patient messages outside the system and that they are able to alter the generic exercises based on individual patient needs.

Nevertheless, the degree of engagement from the local IT department can determine whether the useful technology for adoption sinks or swims. Individual hospitals within the overarching NHS are nothing if not silos in the context of technology adoption. Each ‘local’ hospital chooses its own technology, rolls out its own local training (both initial training and rollout repeated training), with no consensus on a national technology adoption strategy for the NHS. Having a clearly defined national strategy would have obvious advantages in terms of consensus on new technology adoption in different hospitals, with lessons learnt taken to each new hospital adoption.

If we are to advance the use of technology in the NHS and capitalise on opportunities to provide more effective patient care, we need to move beyond more typical demarcation lines to avoid 'siloed' thinking. The lessons for us include the imperative to engage all the stakeholders at an early stage of the intervention and understand the stakeholders’ needs from multiple perspectives. De-siloed thinking needs to extend beyond the local hospital boundaries into the development and adoption of a national technology strategy with national platforms that enable the sharing of lessons between hospitals.

Reference