

Title: Healthcare Technology Co-operatives: Innovative about Innovation

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Abstract

The paper provides an introduction to the National Institute for Health Research Devices for Dignity Healthcare Technology Co-operative. Embedded within the NHS, Devices for Dignity identifies areas of unmet clinical need and translates these into research and development projects to develop new medical technologies. It addresses the needs of people living with long-term conditions, helping them to live more dignified and independent lives. Through partnerships with patients, universities, the NHS and industry, Devices for Dignity has developed an innovation methodology for successful medical technology innovation.

Introduction

The NHS needs to be more innovative in order to deliver better and more care with less resources. Technology has a major role to play in the provision of better healthcare but only if it is applied to the right problems in the right context.

In order to ensure the *problem owner* and the *problem solver* are ‘talking to each other’ the NHS needs to work more closely with the wider public and private sector.

Healthcare Technology Co-operatives (HTCs) are National Institute for Health Research (NIHR) funded centers of expertise that work collaboratively with clinicians, patients, academics and industry to develop new medical devices, healthcare technologies and technology-dependent interventions that improve treatment and quality of life for patients [1].

Based within an NHS Trust, an HTC acts as an effective gateway facilitating the ‘talking.’ It enables industry to gain insight into the challenges facing the NHS and for NHS staff and patients to articulate those challenges; ultimately leading to new collaborations to solve those problems. Devices for Dignity HTC (D4D) identifies areas of unmet clinical need within the NHS and care system and translates these into active projects to design and develop new technologies to address those

needs. Through partnerships with industry, it facilitates the commercialisation of the new healthcare technology products.

D4D has developed an effective model for this process ensuring all important stakeholders are involved in any new product development project and has demonstrated the potential for this model to lead to an acceleration of new products to market.

Background

In 2004, the Health Industries Task Force was established to identify opportunities for co-operation between the government and the UK healthcare-industry that would bring benefits for patients and service users, health and social care services, and industry. This initiative identified the need for a closer working relationship in delivering high quality care for patients whilst developing the UK's technology base. The outcomes described the need to stimulate more *innovation* and encourage a more *entrepreneurial culture* in industry and the NHS [2]. One of the suggested initiatives was the development of HTC's as new concepts which would facilitate the essential collaboration between the NHS and industry.

Two pilots were funded in 2008: Devices for Dignity HTC based in Sheffield Teaching Hospitals NHS Foundation Trust (STHFT) and Enteric HTC, based in Barts Health NHS Trust. These pilots ran for five years and following an independent review, were deemed to be a success in 2012 [3] and in 2014, eight HTC's were set up across England in response to an open competition [1].

Innovation and Entrepreneurship

From a business point of view, innovation is regular and focussed change to survive in the market and it is well established that those who do not invest in innovation put their future at risk [4]. The innovation could be a new process to enable operating efficiencies, could be a new service or product or an improved service or product.

Fundamentally it is about spotting problems and doing something different to solve the problems. From a commercial point of view, it is about spotting opportunities and creating new ways to exploit them. But innovation does not happen automatically; it is a managed process and is driven by entrepreneurship. Entrepreneurism has been described as *“a potent mix of vision, passion, energy, enthusiasm, insight, judgment, and plain hard work which enables a good idea to become a reality”*. [4, pg 10]. The process is not simple and the innovator must be prepared to take risks and accept failure.

The NHS has a very important reason to innovate; it must find a different way of delivering care to enable it to deliver more and better with less resources. In this context, innovation can be described as *“an idea, service or product, new to the NHS or applied in a way that is new to the NHS, which significantly improves the quality of health and care wherever it is applied”* [5, pg 9].

If innovation is driven through entrepreneurship, then the NHS must create the right culture which accepts that the ability to make this change requires risk and initiative. More usually described as the drive of an individual to make profits, entrepreneurship in the NHS is the ability of the organisation to take the risk to try something new. This challenge involves encouraging individuals within the NHS to become ‘intrapreneurial’ and strive to make changes [6].

The development of new medical technology is a complex and lengthy process requiring collaboration across numerous stakeholder groups. Adding to the complexity is the fact that the views and needs of the many stakeholders are often not only complex, but contradicting and need to be heard through-out the development process [7].

Creating the environment where all relevant individuals are involved in the innovation process at the right time is essential. The challenge in healthcare is that the full-set of skills and knowledge required spans public and private sectors involving many different organisations and individuals. Recognising the complexity, the NHS and its employees have a key role to play as *part of* the innovation process by being members of these cross-sector diverse teams.

The *internal intelligence* of the NHS workforce to identify the essential problems needing a solution is one of the NHS's most valuable resources. Enabling the translation of this enormous intellectual capital into new products or services whilst still allowing NHS staff to deliver on their day job is the role and value of organisations such as D4D.

The National Institute for Health Research Devices for Dignity Healthcare Technology Co-operative

D4D's mission is to *deliver innovative healthcare technologies that preserve dignity and promote independence for patients living with long term conditions.*

Hosted by STHFT it is a national consortium of seven NHS trusts and four Universities [8]. D4D employs a team of experienced individuals, each with different skills and knowledge related to technology development, who work as a core team providing the basic infrastructure for our many collaborators. In addition, D4D has a team of expert clinicians who dedicate a percentage of their time to leading individual programmes of work within their specialism.

D4D's NHS partners are: Leeds Teaching Hospitals NHS Trust, Central Manchester University Hospitals NHS Foundation Trust, Barnsley Hospital NHS Foundation Trust, North Bristol NHS Trust, Newcastle-upon-Tyne Hospitals NHS Foundation Trust and Sheffield Children's Hospital NHS Foundation Trust. Our University partners are: University of Sheffield, University of Cambridge, Coventry University and Sheffield Hallam University. In addition we have the Bladder and Bowel Foundation as a charity partner.

Why the focus on Dignity?

The D4D innovations are especially pertinent in that they address unmet needs in basic activities of daily living which may lead to loss of dignity and independence. Failure to address such fundamental human needs also contributes to deterioration in patient wellbeing. Too often, medical devices are developed in response to technological advance and perceived market demand but the key

requirements of clinical efficacy and patient acceptability are not always prominent in device design. Many areas of patient need, including privacy and dignity, are not being addressed because the market voice is unheard (people do not like to publicise that they have problems that are impacting upon their dignity) or patient advocacy may not be sufficiently strong. In addressing dignity and utility, D4D is exploiting a generic device development and evaluation methodology, which crosses clinical boundaries and delivers healthcare benefits across the age spectrum.

D4D focuses on three inter-related clinical application areas (themes) that are commonly associated with poor patient experience through loss of dignity and independence:

- Urinary continence management
- Renal Technologies
- Assistive and Rehabilitative Technologies

Urinary continence management: Urinary incontinence affects ~25% of the population. It has a devastating effect on quality of life and can result in loss of employment and social isolation. It is the second most common reason for older people moving into care. Devices play a **major** role in prevention, alleviation of symptoms and, importantly, in management of continence where drugs or surgery are inappropriate or have failed, and are vital to restore independence, enabling individuals to regain a positive contribution to society.

Renal Technologies: New technologies will benefit those with advanced kidney disease (costing 2% of NHS budget) and the increasing numbers with chronic kidney disease (CKD) - the overall prevalence is 14% of the UK population. CKD increases markedly with age (>25% in those over 65 years) and is associated with high morbidity and mortality. In those whose CKD has progressed to the need for dialysis, 80% report significant reductions in quality of life due to reduced independence caused by restrictive technology.

Assistive and Rehabilitative Technologies: There are over 11 million people with a limiting long term illness, impairment or disability in the UK. The prevalence of disability rises with age (~6% of

children, 15% of working age adults, 45% aged over 65) and is increasing with the ageing demographic. New technologies (e.g. communication aids, dysphagia treatments, restorative rehabilitation technologies) will benefit those living with or recovering from physical, communication or other disabilities.

The D4D approach

D4D stimulates innovation by creating a platform where patients, carers, clinicians, academics and industry work together. The basic components of the D4D methodology are identifying and validating unmet needs, translating these needs into development projects and commercialising successful technologies through collaboration with industrial partners.

Identifying unmet needs is facilitated through our position as a clinician-led collaboration which acts as a focus for “technology pull” into the NHS. Ideas for new products come from the wide range of specialist knowledge of the experts we work with (users, carers, industry, academics, healthcare experts) and through the public facing website [8].

Having identified unmet needs, these are reviewed, validated and prioritised. This process delivers an evidence-based needs analysis and catalyses technology development opportunities and partnerships. Key to getting the right team together involves identifying the right technology development partners, involving users and purchasers and collaborating early with industry. These teams undertake proof of concept (PoC) project work to:

- turn a concept into a formal user-centred design specification for the technology and an exploitation plan
- Develop the [early stage] technology and generate preliminary evidence of its potential value to all of the stakeholders involved

This methodology ensures that the project addresses the important parameters that will accelerate both partnership creation and market opportunities.

The output of a PoC project is robust information intended to de-risk a future technology development to justify further investment into the development process, usually via a grant application or through private investment.

An essential part of any new technology development is to consider how we can maximise the chances of getting the product used in the NHS. D4D's approach is to ensure the problems it chooses to solve do indeed meet a need that the NHS wants to solve. D4D works to understand all these parameters at the start of the project by working with the end-users and customers throughout the development path. There is always going to be risk associated with new product innovation but by taking care of these basic principles the level of risk is lower.

Why this approach works

Innovation in the NHS is not about the NHS doing it all themselves. It is about being part of the innovation process. The skills required to spot the problems to be solved are essential, but the staff on the front line cannot be expected to spot the problem, come up with an idea for a solution, develop the solution, create the market and implement the new solution at scale across the complexity of the NHS.

NHS employees should be enabled to be part of diverse teams working together with relevant industrial, academic and user partners to address relevant issues. The development of new medical technology is a complex and lengthy process. Our experience over the past 6 years is that anyone might come up with an idea but translating this through to successful innovation can become blocked due to:

- The idea being at a very early stage and unable to attract funding
- Not yet designed to fully meet patient needs
- Endorsement by leading clinicians/patient groups often overlooked

- The complexity of development hurdles being underestimated (e.g. regulatory) and hence unrealistic expectations
- Limited understanding of IP and legal issues leading to an unwillingness to collaborate or a leakage of IP as the idea is shared publically preventing future protection.

All of these challenges can be overcome by working as part of a diverse team in a managed innovation process. There are some basic components to why the D4D model works:

- Access to an extensive knowledge base across the public and private sector through D4D's immediate resources and wider networks. This access, combined with the generic device development skills to ask the right questions enables D4D to assimilate and integrate the knowledge from the networks of specialists maximising the value of these expert individuals.
- The D4D teams have the skills and contacts required to bring the right people together and then create tangible outcomes from those collaborations. This ability to create teams and nurture collaboration through relationship building is fundamental to success in this field. The environment for innovation created in D4D enables collaborations to grow strong through dedicated relationship building. Innovation can be a challenging process and so building trust across partners is essential [9].
- Running a portfolio of projects enables the consortium to accept a certain amount of risk with respect to tackling challenging projects. Accepting the risk of failure is part of the innovation process.

Partnerships for Impact

The HTC's are a key part of the innovation system within the UK [10] which includes many institutions within the public and private sector who recognise the need to collaborate to innovate.

Within the medical technology industry sector, the key challenges facing companies today are the requirements to distinguish their products based on both value and outcome [11] and it is recognised that the growing power of patients is a key change factor influencing the success of the

sector. Collaboration in order to understand the product within the 'patient pathway' and accessing this valuable information is essential for success.

Conclusion

The core strength of D4D has been the ability to bring together teams of people with the right knowledge, experience, resources and ambition to develop new healthcare technologies to solve problems for patients. In-depth understanding of the healthcare system is a key success factor for the development and implementation of new healthcare technology and being embedded within an NHS trust ensures D4D has access to this knowledge. D4D has developed a partnership model enabling and fostering collaboration between the many different contributors required to deliver successful new technology developments.

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