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## **Adoption, adaptation, surface compliance and obstruction: responses to new technologies in healthcare**

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### **Abstract**

The UK National Programme for IT is spearheading the digitisation of health information, but relatively little attention has been paid to how these technologies are received or integrated into working practices. In this paper we reflect on the findings from a series of studies on technology design and deployment in NHS hospitals, focusing on the responses of the users of those technologies. The studies took two complementary approaches. Some studies focused on experiences and perceptions of digital libraries (i.e. sources of non-personal health information); others were focused observational studies of the introduction of new technologies (including patient information, patient booking and patient record systems) in particular healthcare contexts. Across the studies, we identified forces for and barriers against technology adoption. Forces for change were found at individual, team, organisation and national levels: where technology and practices could adapt to better fit each other, technology acceptance and exploitation created a positive environment for adopting new ways of working. Conversely, barriers to change were found to relate mainly to individual and team working; they arose when individuals' or teams' values were at odds with those implicitly embodied in new technologies, and resulted in subversion of technology use that led to conflicts between formal and informal working practices.

### **Introduction**

Globally, there is a move towards the digitisation of health information – both personal information such as health records and non-personal, such as research findings, policies and procedures. If this shift towards digitisation of health information is to result in improved health care then it is essential to understand the interrelationships between technology design and deployment and the acceptance and use of that technology. This paper brings together the findings from a series of studies on the deployment of new technologies in healthcare, focusing on emergent themes from those studies.

### **Background**

There is some recognition (e.g. [4]) of the need for new technologies to fit with working practices, and of the tensions between the role of information in supporting patient care and its role in supporting organisational standardisation and audit. In addition, recent studies have highlighted some of the social obstacles to the rapid deployment of new IT systems; for example, Littlejohns et al [7] highlight the need for users to understand the purpose of new systems that

are imposed on them, while Hendy et al [6] identify a point of conflict between national policy makers and local managers in the current National Programme for IT. The work reported here contributes to this understanding, relating social structures and the changing roles of managers, staff (clinical and support) and patients to the evolving IT landscape.

The diverse organisational culture of hospitals, made up of many different professions with their own specific social identifiers that form co-existing Communities of Practice [11], can often produce conflicts between those professions [8]. Symon et al [10] found conflicts within a clinical setting relating to social status and information practices. For example, higher status professionals were found to be more concerned with keeping their social status as experts within the organisation than adhering to formal organisational norms. It is competing organisational norms, particularly regarding status and expertise, which can lead to technology being perceived as tools for both individual empowerment and hierarchical dominance. The work reported here has analysed the competing and cooperative forces of technology within health service settings.

## **Method**

The individual studies applied qualitative research methods based around participant observation, in-depth interviews and focus groups. There were two strands to the work: the main one focused on experiences and perceptions of digital libraries across a variety of work settings; the secondary one involved a series of observational studies of the introduction of new technologies (including patient information, patient booking and patient record systems) in particular healthcare contexts. Participant observations over these different contexts, examining diverse technologies, enabled us to draw out thematic continuities across settings.

For each study, formal ethical clearance was obtained and all studies were conducted in compliance with that ethical clearance. Technique selection was driven by both the issues under investigation and concerns of ethics and access to what are necessarily sensitive and time-pressured work settings. Grounded Theory analysis techniques were used to develop a well-founded account of changes and their interrelationships, for a range of user groups and within a variety of clinical settings. User groups included patients and their representatives (such as patient liaison officers), clinicians and other healthcare professionals (such as librarians and IT staff); settings were both urban hospitals, including a teaching hospital, and rural hospitals. Overall, the studies involved about 200 participants across 8 different NHS Trusts.

## **Results**

Across the studies, various themes emerged; one of the dominant themes, on which we focus in this paper, was understanding the forces for and barriers against technology adoption. These forces and barriers became apparent through the individual, team, organization and national forces that promote and resist new technology developments.

We identified situations in which new technologies were embraced and adopted effectively to enhance working practices; we also identified situations in which barriers to change were erected: where new technologies were actively opposed, or where staff engaged in surface compliance while finding workarounds that subverted the use of the technology. Broadly speaking, forces for change emanated from policy makers and managers with a view of the 'big picture' while resistance to change emerged from individuals and teams. Instances of positive technology adoption were explored to understand the factors that created such

opportunities, while instances of resistance and 'surface compliance' highlighted conflicting value systems between stakeholders. Together, the studies form a body of work highlighting opportunities and dangers of technology adoption.

One striking feature of the studies was that all respondents appeared to accept the inevitability of change, and recognised that this would have an impact on their working practices and relationships. However, there was little apparent awareness of the factors that enable the positive effects of change to outweigh the negative effects.

### *Forces for change*

Factors promoting technology adoption could be identified as relating to different levels of concern: individual, team, organisational and national.

At the individual level, technology was regarded as empowering users, by providing them with effective tools for completing their tasks efficiently and to a high standard. Technology was seen as increasing individual freedom and power – both for the individuals advocating technology adoption and for those who currently have limited access to information and technology (typically nurses and Allied Health Professionals). For example, one student nurse explained:

*"We should be given the opportunity to learn as much as we can, be as much, be as effective as we can be for the sake of the patients"*

An important influence on the acceptance of technology was whether it resulted in the democratisation of information – whereby information is made available to all, regardless of role or status. A related perceived benefit was that the boundary between theory and practice should be reduced and that everyone should have timely access to relevant, high-quality information. Under this view, traditional patterns of information dissemination (through hierarchical power structures) is regarded as paternal, and democratisation as empowering.

Considering team working, it was found that technology could facilitate improved communication and collaboration. For example, at one hospital, an organizational awareness server [2] was developed as a screen saver application, initially to increase privacy and security (particularly of patient data, which might be inadvertently left displayed on an unattended screen). This application evolved into a new communication medium improving communication across the organization. The study highlighted the iterative and organic development of the design through stakeholder involvement. Staff from across the hospital became involved in the design of the system and, as the project matured, with the selection of information to be displayed on the screen savers, making it into a highly effective mechanism for raising organizational awareness. Another reason for system effectiveness was that it meshed well with working practices, only appearing when people were not engaged in intensive computing activity and being available for glancing at during more quiet or social moments in the working day. This application and the evolutionary process through which it was developed were found to not only increase awareness of resources, activities and hospital changes but also positively influence users' perceptions of, involvement in and ownership of general IT developments. User involvement also raised the importance, for the designers, of application usability, quality and aesthetics.

At the organisational level, the focus of the argument in favour of technology adoption centred around accountability and efficiency. It was believed that technology could improve clinical audit and would also reduce costs. An NHS manager commented that:

*"the benefits of it are going to be colossal, really."*

While technology deployment is one prevalent approach to enforcing change in working practices, another approach identified was through clinical governance, implemented through intermediaries (such as Multi-Disciplinary Team Co-ordinators, MTDCs) who encouraged (explicitly and implicitly) accountability and conformity of the clinicians with whom they work. This approach, with or without pervasive technology support, is leading to a strong audit culture.

At the national level, technology adoption was seen as a means of achieving improved standardisation of practices and the democratisation of information. Whereas historically clinical best practice was ensured through clinical care pathways, there is increasing reliance on technology to disseminate and enforce best practice. This is closely aligned to the national drive for Evidence Based Medicine, whereby clinicians are required to take account of current best evidence in diagnosis and planning treatment for every patient.

One striking feature of many interviews with senior management and policy makers was the evidence of a 'computer cult'. This is an unshakeable belief in the ability of technology to effect change – to both working practices and social norms. For example, a Clinical Governance Manager asserted that:

*"You know that it is actually going to inform you and support practice and make changes."*

Negative experiences (e.g. of technology failure) are dismissed as small inconveniences when set against the perceived powers of technology and the intrinsic value of digitisation. For example, one radiographer reported that:

*"and we looked to have lost - because the backup system didn't work properly - some six to eight thousand patients examinations"*

Yet the same individual also noted that:

*"we're very much looking at becoming a completely film-less, paper-less environment."*

The concerns of others over technology developments are discounted, and doubters are to be 'converted', typically through the recruitment of advocates to act as technology champions. However, such technology champions can have a negative effect on technology adoption because they disrupt power relationships and others' sense of ownership.

### *Barriers to change*

Whereas the forces for change that were identified cover a broad range of factors, from the individual to the national, the majority of barriers to change were found to relate to individuals and team working.

Individual professionals' values were found to conflict with the implicit values embodied in new technology. Standardisation and conformity work against individuals' creativity and undermine their pride in their knowledge and skills and ability to solve problems creatively, removing their freedom to act in ways they consider most appropriate to local contextual factors. This, in turn, diminishes individuals' sense of control over their work. For example, one radiographer noted:

*"using remote requesting comms and requesting algorithms that will insist on them providing the information that we require prior to being able to access our lists."*

Health experts (particularly consultants) reported that they maintain their expertise by keeping up to date with the literature in their specialist areas, rarely by explicitly referring to literature within the context of an individual consultation. Daily decision making is most commonly based on their own and colleagues'

clinical expertise. Discussion with colleagues was rated much more highly than reference to literature sources as being more timely, being a way of validating provisional assessments and of interpreting the relevant clinical information in the context of the problem at hand [1]. This low prioritisation of 'authorised sources' of information was perceived by some other staff (nurses and management) as arrogance. This suggests that a deeper understanding of expertise in practice is needed to enhance the design and implementation of technologies such as digital libraries. Also, the importance of information mediation and interpretation need to be recognised; this is discussed further below.

Clinicians – particularly the more senior – also reported working under a set of constraints that limited their ability to adopt new ways of working based around new technologies. These included lack of relevant skills and knowledge regarding how to use the technology (IT literacy), and lack of time to learn the technology and to work out how to adapt working practices appropriately [9]. Digital libraries, in particular, were reported to be difficult to learn and to use: one surgeon [1] described the provision of digital libraries as:

*"like being given a Rolls Royce and only being able to sound the horn".*

Many individuals expressed distrust – often based on experience – in the reliability of technology, and frustration at the poor availability of systems. One factor relating to deployment of technology in hospitals is that many computers are shared by several people at any one time; this creates a hierarchy of needs, whereby time-critical tasks such as accessing patient data or booking appointments are perceived as having higher priority (and implicitly more intrinsic worth) than staff development or communication activities such as accessing digital libraries or using email. One example of such prioritization was found in our study of time management practices in three outpatient physiotherapy departments with different paper and electronic systems [5]. The study highlighted several potential barriers to the effective deployment of electronic booking systems including poor resource and training provision, concerns regarding restrictive diary control measures, the continued reliance on burdensome duplication procedures and the need to coordinate multiple information artefacts, which need to be addressed if electronic booking is to be successfully designed and deployed. This highlighted the perceived distinction between technology to support theory and practice. Systems increasing theoretical knowledge were described by various participants as "playthings".

Team working is central to health service practice. The theory of Communities of Practice [11] recognises the prevalence of locally evolved work practices and values that rely on collaboration and communication within and between teams. This conflicts with standardisation: standard work practices are viewed as being, at best, restrictive and time-consuming and, at worst, oppressive and controlling. Thus, at the team level, technology was opposed where it enforced working practices that restricted well-developed team interactions. The factors opposing community technology take-up typically resulted in information hoarding practices, often achieved by hoarding technology (e.g. moving computers from shared areas into areas that are the 'domain' of one individual or group of staff or introducing authentication mechanisms on computer systems), which in turn fostered resentment by the staff who were thereby excluded [1].

In parallel, the poor usability of many systems means that they cannot be readily adapted to local needs, resulting in a need for technology intermediaries to operate the technology on behalf of users, increasing people's sense of alienation and lack of ownership of new ways of working.

## *Effects of change*

The forces for and barriers to change as outlined above also produced social and organisational effects. Changes in information availability produced changing information needs and support. Broadly speaking, technology and work-practice changes resulted in corresponding individual and community adaptations to ensure their own needs continued to be met. This frequently meant new roles were produced to support the shortfall of technology (e.g. outreach librarians, MDTCs, patient information officers). These new roles often increased the acceptability of the changes.

Our studies highlighted the central role that Communities of Practice play in the ways professional teams adapt their practices and their technology use. In particular, such communities evolve informal working practices that overlay the formal processes and that adapt to local circumstances. Technologies (such as digital libraries) have been found to serve as boundary objects mediating communication between interoperating communities. Within the context, technology has been found to empower or exclude users according to their positions within the relevant Communities of Practice [1].

Both formal (professional) and informal (e.g. clinical expert) intermediaries were found to have a key role in empowering others to use information systems and interpret the information returned by such systems. For example, in one study, clinicians reported that knowing an outreach librarian was on hand to help them if needed gave them confidence to explore new technology. A clinical psychologist explained it:

*"I think it encourages me to begin to do more myself because she's there ... The whole technology side doesn't become so overwhelming and daunting."*

In other settings, clinical librarians and others with intermediary roles such as MDTCs were found to be developing a role that was central to professional effectiveness, relying heavily on trust and respect for that individual within the organisation. For example, MDTCs were found to build relationships of trust within a clinical team such that they could encourage changes in working practices that exploit the benefits of technology while also improving auditability and standardisation. For example, a manager responsible for Clinical Governance explained that:

*"there are audit leads, a clinician in each of the specialties who takes that responsibility as audit lead for you know, their own specialty so they have a responsibility to know what's going on, to make sure they have a plan for here."*

We also noted evolving relationships between clinicians and patients, in which the role of clinician is transforming gradually from information provider to information interpreter [3]. For example, clinicians may advise patients to search for information and bring it to a future consultation for discussion in relation to their clinical needs and treatment possibilities.

## **Conclusions**

In summary, this work has highlighted both conflicts and resolutions in the evolution towards more democratic information provision and the digitisation of health-related information. We have found that many of the barriers to change are caused by unrealistic expectations and shortfalls in technology. Key shortfalls often relate to social attributes (e.g. trust, information interpretation) that are established through social relationships.

We have highlighted forces for, barriers to, and effects of new technology adoption in healthcare. One essential challenge exposed by this work has been that of how 'bottom-up' evidence can be brought to inform 'top-down' healthcare policy and decision making in a context of constant organisational change and strong adherence to a 'computer cult', in which people express strong belief in the ability of technology to effect positive change regardless of evidence to the contrary.

Forces for change can be found at individual, team, organisation and national levels. For example, at the individual level technology can empower users if it provides effective tools for supporting working practices; at the team level, it can facilitate effective communication; at the organisational level, technology can improve staff accountability and efficiency; and at the national level, technology is believed to improve standardisation of practices (e.g. across NHS Trusts) and improve information access for all.

Barriers to change were found to relate mainly to individual and team working. They arise when individuals' or teams' values are at odds with those implicitly embodied in new technologies – for example, standardisation can undermine individuals' pride in their knowledge and ability to find creative solutions to immediate problems – or where there is a poor fit between new technology and established working practices. The imposition of new technologies that cannot be readily fitted with working practices results in surface compliance in which organisational structures and practices are subverted through personal interactions and tacit knowledge.

New roles are being created, both formally and informally, that provide support for the shortfall between technology expectations and realistic outcomes. For example, information intermediaries are often needed to interpret information in the context of the problem at hand: an intermediation role that is often performed by peers (for clinicians) or health professionals (for patients). The provision of digital information may make information more readily available to those who need it, but there remains a widespread need for interpretation of that information.

Where the conditions are created in which technology and practices can adapt to better fit each other, technology acceptance and exploitation can create a positive environment for adopting new ways of working. Conditions for this include placing value on different kinds of knowledge and expertise, creating realistic expectations of the technology, making the technology clearly usable and useful, and giving people a sense of engagement with the design and use of technology.

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