Experiences of clinical staff during the introduction of mobile technology systems in acute care wards

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This paper presents an evaluation of staff experiences before, during and after a large scale deployment of mobile technologies within an acute hospital. Qualitative data from thirteen clinical participants were analysed. We report on the impact on clinical working practices, staff experiences and acceptance of the mobile technologies, and the understanding how the technology is used immediately after deployment. This process provides thematic insight into the deployment process, what has been achieved and how future technology implementations in large hospitals can be improved.

Keywords: mobile technologies, interviews, user experience, acute care ward, hospital environment

1. Introduction

In recent years the use of health information technologies (HIT’s) in healthcare organisations has gained traction and schemes to replace paper based practices with mobile and digital solutions are being implemented to varying degrees. Information communication technologies (ICT’s) are often perceived as key enablers for gaining efficiencies and improving quality of care (Fitzpatrick & Ellingson 2013) however little is known about the impact of those technologies on staff experience and practice, particularly during the early stages of deployment when staff have to adapt to the new systems in place. The relatively recent and rapid introduction of HIT’s for a wide variety of tasks; electronic patient records, clinical decision support systems and high level resource management and organisation of healthcare environments, has meant that technology capability and cost-benefit analysis has sometimes overshadowed the need for understanding of the impact on healthcare working practices and user and stakeholder experiences (Rahimi & Vimarlund 2007). There is therefore a need within this space for evaluation of HIT’s and mobile technologies, including how they are adopted and used in practice and what the impact is on quality of care, patient safety, efficiency within the healthcare system, staff and patient experience.

This study reports on a large scale ICT initiative and deployment of mobile devices for clinical working (mobile phones and tablets) to individual staff in a large hospital and focuses on the impact within acute care wards. The aims of the study were to:

• Evaluate the impact of handheld technologies on staff practice within ward environments
• Gain a greater understanding of the way in which handheld technology is used by staff
• Provide guidance for future implementation of technology in hospital environments
• Report on staff satisfaction with regard to the change in technology and practice

The paper presents a thematic analysis of qualitative focus group and interview data, describing staff experiences during the introduction and first 4 months of handheld mobile technology use in the ward, reflecting on the process and the impact on clinical and non clinical working practices. The conclusions offer guidance for future healthcare technology deployments and discuss how a smooth integration process through positive experience and acceptance can benefit clinical practice.

1.1 Background

The implementation of HIT’s (both software and hardware) as infrastructure and resource within healthcare contexts is perceived to be an important development and tool for healthcare providers as they face challenges associated with financial constraints and increasing demand on healthcare systems (Fitzpatrick &
Ellingsen 2013). Perceived benefits of efficiency, connected health and shared infrastructure underpin the continued drive for investment in technology integration in healthcare systems. HIT integration is seen as supporting multidisciplinary healthcare teams by; “supporting information flows, sensemaking, decision-making, communication, negotiation, awareness” (BergBerg 1999) and facilitating at complex junctures for example ‘handover of patient’ (either temporal or location) and in cross discipline and hierarchical communication (Cabitza et al. 2005). The deployment of mobile technology in secondary care environments (hospital) and particularly in acute care settings is particularly complex, where time pressures, patient diversity, suboptimal environments and communication channels contribute to a high pressured and varied workload (Williams et al. 2013). This study explores the introduction of mobile technologies, primarily deployed for clinical staff to carry out observations tasks and record them electronically rather than on traditional paper documentation.

1.1.1 Learning about HIT uptake and acceptance

In order to provide evidence-based guidance for future integration and use of technology in these specialist environments there is a need to explore the contextual factors related to HIT use and “the process of change” so that organisations may learn for future ICT initiatives. This approach is advocated by McAlearney et al. (2014) in their research into the introduction of an Electronic Health Records (EHR’s) system where the aim was not only the successful deployment of the new HIT but also “to improve their collective understanding of [EHR] implementation strategies to advance adoption and implementation”. As such, not only do ICT deployment teams have to think about the practicalities and logistics of these changes in practice but also consider factors of technology literacy, training, financial, technical, psychological, social, legal and organizational culture, which contribute to technology acceptance (Boonstra & Broekhuis 2010).

One important backdrop to this study and with regards to future technology deployments is the reporting of negative findings. Buntin et al. (2011) report the need for “studies which document the challenging aspects of implementing health ICT and how these challenges might be addressed”. As stated, there is very little in the literature about staff experience, despite the emphasis on ‘continuous quality improvement’ so this paper aims to introduce insight from clinical staff who have either deployed or experienced the introduction of mobile technologies for use in healthcare contexts.

1.1.2 Context of HIT deployment process

The study took place in a large teaching hospital trust, over two large hospital sites in the East Midlands region of the UK. The trust employs approximately 12,000 staff and has approximately 2,500 beds. The trust is moving away from paper based to electronic working and the implementation of individual work devices for staff is a step change in clinical working practice. The ICT deployment constituted a major infrastructure project and ran from November 2014 to March 2015, during which over 4,500 mobile technologies were given out to ward staff. The mobile phone and tablet devices run off the iOS platform and the initial software usage by users includes (but is not limited to) recording patient observations and calculating early warning scores (eObs), accessing health records, e-prescribing and requesting test results. The primary resource and driver for the roll out of individual devices is to facilitate improved process for patient observations. For the duration of the project a clinical ICT deployment team were recruited from their normal clinical roles to roll out the technology to staff in the trust and to support their user needs during initial uptake and short term use. Wards were allocated ‘go live’ days where staff were given phones to use in place of paper observation charts. During the first week following ‘go live’ date the deployment team were on hand to support the users and were on call for out of hours queries.

2. Method

The study comprised a ‘service evaluation proposal’ and entailed recruitment and data collection on National Health Service (NHS) premises. Ethical approval was sought from the local University Ethics Committee Panel. NHS Ethics was not a requirement due to the study design of ‘service evaluation’. The interview schedule was developed in conjunction with the senior clinical applications specialist and the research nurse coordinator with experience of HIT deployment. Semi-structured interviews and two focus groups were carried out in the hospital at the convenience of clinical participants. Data collection tasks had to accommodate clinical commitments and as such the duration of interviews was quite varied, additionally
interviews were sometimes interrupted by technology notifications of phone calls about clinical responsibilities. The interview schedule was separated into enquiries that tackled three different timeframes of the implementation of mobile technologies in the wards. Due to the semi-structured nature of the interview questions these timeframes were not always discussed sequentially and the interviewer enabled the participant to help direct the line of enquiry as new experiences and perspectives were relayed.

### 2.1 Participants

Two types of interviewee were recruited for the study, ICT Deployment team (all with clinical backgrounds) and clinical staff with experience of using the mobile technologies in the ward. Participants were recruited via a ‘snowball’ convenience method whereby a senior critical care consultant and clinical applications specialist involved in the project management of the hospital wide technology deployment, disseminated recruitment emails to their clinical networks. In total 13 clinical staff members were recruited for inclusion in the study.

- **Focus Group A** - five participants from the Clinical ICT Deployment Team all with backgrounds and experience in clinical work. (1 male/ 4 female).
- **Focus Group B** - four participants one senior ward nurse (female), two shift nurses (1 male, 1 female), all with experience in different clinical wards. One healthcare assistant no prior clinical experience (female).
- **Interview A** – Endocrinology Ward Sister, Female
- **Interview B** – Respiratory Ward Sister, Female
- **Interview C** – Clinical ICT Research Nurse Male
- **Interview D** – Respiratory Ward Staff Nurse, Male

Twelve participants had prior experience of paper based working within the hospital environment. Four of the participants stated that they had experience of using ICT systems in work at previous hospitals. The members of the clinical ICT applications team deploying the technology had experiences of managing the deployment process, supporting staff members during the roll out and using the technology themselves.

### 2.2 Data Analysis

The qualitative data sets were analysed using a thematic analysis process (Braun & Clarke 2006). To conceptualise the full data set the focus group and interview transcripts were analysed together to ensure that emergent themes were representative of the overall story within this research case. This analytic task used the following process - familiarisation with the data, generation of preliminary codes, identifying emergent themes, reviewing themes and then defining and (re)naming the themes. The initial stage of coding for these data sets was the division of the qualitative accounts into the timeframes of the technology deployment process. This preliminary distinction was made in order that the results could report on the pre, during and post deployment phases of the technology implementation. Following this first phase of coding the data were thematically analysed for emergent concepts. This paper does not present an exhaustive list of themes but gives insight into the experiences of staff involved with and impacted by the deployment.

### 3. Results

The following section reflects on the main findings from the interviews and provides subjective evidence of the impact of new technologies on staff experiences and working practices. Sections 3.1, 3.2 and 3.3 provide analysis of the qualitative data whilst section 3.4 provides an overview of the emergent themes in relation to the deployment process.

#### 3.1 Pre-deployment of HIT

Clinical staff and members of the clinical ICT deployment team expressed the view that prior to the roll out of technology more could have been done in terms of training and communication about the hospital wide initiative. The deployment team acknowledged that attempts had been made to inform and engage users before the deployment commenced, however it was suggested that in the context of work and prioritisation within acute care and the hospital environment, awareness campaigns about this (and other initiatives) are often hard to engage with. Six of the persons interviewed made reference to ‘improved information flow’ about the reasons behind the roll out of the technology and the observation software which comprised the main driver for the service improvement scheme. It was suggested that in this situation “a better understanding of what people will read and pay attention to whilst at work and how to get them to engage”
(FG-A) would benefit future ICT implementations, however it was also acknowledged that “to engage people and access consultant meetings and those at the top, would be a full-time job in it’s own right!” (FG-A).

There were reports of enthusiasm from staff about the impact that the technology would have on working practices, particularly from users with a degree of technology literacy. Resistance to the scheme was mostly evident from clinical groups who perceived that workload would increase. It is evident that more could be done within the planning stages of large scale projects like this to ensure that plans are put in place which successfully target users with the information they need to ease the technology deployment process. “It’s all about the communication and I think there could’ve been a bit more done in some ways to help the roll out so we knew what to expect”. (FG-B). Experiences of the deployment team also made reference to the cultural backdrop and hierarchy within hospital environments. It was considered that ‘improved buy-in’ was required from senior staff members as “what they say and do has influence over the acceptance and attitudes of other staff groups” (FG-A). Two of the team mentioned the difficulties faced when trying to engage senior staff and felt the need to ‘persuade’ them to listen. The deployment team recounted the need for additional training, in regards to their own use of the device and also in their role of having to train clinical users. From the viewpoint of the clinical users, there was no exposure prior to ‘go live on the ward’ in which staff could familiarise themselves with the mobile hardware or the software. Feedback from senior ward staff have suggested that “one of the main problems was that we didn’t all have a charged phone before the day and there was lots of faffing with that.....I think all of us felt nervous on the day and we didn’t need to. I think if we’d had the phones to have a play with a few days before would’ve made that easier.” (Int B). Later in the deployment process it appeared that the ICT team had responded positively to feedback from users in the ward and built in time for a senior member of the ward to have time with the device prior to the roll out.

The subjective reports demonstrate that despite being generally enthused about the implementation, staff were stressed and nervous about how it might impact them and whether they would cope with the adaptations in practice. “Even I was nervous on the day, there wasn’t one of us who knew what was happening. I didn’t feel prepared and I’m very up for technology...But I had staff who didn’t sleep the night before.” (Int B). Whilst the deployment team had received feedback that some users had enjoyed the opportunity to train on the device whilst using it in the clinical environment, there was also feedback that others did not feel confident using it for the first time ‘live’ and would have preferred a less intense and stressful introduction. “I had to deal with a very worried individual, an experienced clinician in charge of a unit but they were very concerned about the technology and required a lot of support and would have maybe benefitted from some early training....they weren’t very tech savvy”. (Int D)

3.2 During deployment of HIT

From the perspective of the deployment team, the roll out process was considered to be a successful and rewarding experience, “I think it’s gone very well, considering it’s such a huge change in the culture and logistically I think it’s gone well, especially considering the scale.” (Int C) There was however feedback regarding the ‘intensity’ of the process and how it was “it was a big learning curve” (Int D). There were suggestions that ‘protected time and environments’ (FG A) for the team to learn before the roll out may have prepared them better to train other clinical staff. The team also suggested that their clinical expertise and backgrounds was of significance to the success of the project, “It’s been handy to be able to say to the nurses I’ll do your drugs round and I’ll do your turns round blah blah blah and they’re like ‘oh thank you so much’ and they’ve actually been able to go off and sit and focus without being worried about whats going off in their bay.” (Int D). This idea was supported by the clinical staff who considered the deployment teams clinical experience a valuable asset during ‘go live’ days particularly as they were able to support clinical practice whilst delivering the system and fitting in with the patient and clinical needs. As with the pre-deployment awareness strategy, there was evidence that certain types of user i.e. those who were less technology literate, were considered by the deployment team and senior ward staff to be the most cautious of the technology and the ones in need of most support. “I found it really bewildering. It’s like you’ve got this bit of equipment and you know what it’s capable of doing but you don’t know how to do it. So it’s about more training really and more support. (FG-B) It was also evident through the accounts of the individuals interviewed that acceptance of the technology, confidence and competence of use increased with exposure to the system.

The issue which appeared to cause the most stress amongst seniors was the requirement to send staff off the ward to collect devices, concern about being under resourced and patient safety was raised as an issue in relation to this aspect of the roll out. “I can’t be releasing staff for 25-30min and it’s there and back. I
should've been given a box the week before to hand them out." (Int B). This situation was eased as additional members of staff were trained up and could then support their clinical team in using the devices. “We struggled with being short staffed when people had to go off for training. Although they [the deployment team] ended up training one of the auxiliaries so she caught the people who were on nights and stuff.” (Int A). Sometimes this was done informally with senior staff initiating ‘mentoring’ within their team whilst other times this was suggested as an improvement, whereby future roll outs should select ‘super users’ within each ward to champion the initiative and provide support to other team members. This was suggested so that assistance and training requirements could be cascaded down from ‘inaccessible ICT support’ or the deployment team, to the super users within the clinical environment. Another issue being reported within two of the wards was the time it took senior ward staff to train temporary staff in their use of the device and how this detracts from time which should be spent on clinical duties. It was suggested however that as mobile devices and HIT become more pervasive within healthcare environments then these agency staff will be increasingly exposed to this way of working so this task will get quicker over time (Int D).

During the deployment process the experiences of patients seem to suggest that patient feedback has been generally positive regarding the use of mobile technologies by staff during their stay in the ward. “The patient said ‘thank goodness the NHS has come into the 21st century’” (Int D) There were however reports of complaints “from patient relatives about staff being on their phones and I’ve had to go out and explain it. But usually once I’ve explained they are ok and they get it.” (Int A) Additionally sometimes patient views of what the devices were did not stem from patient feedback but rather staff perception where they felt “people are watching and looking at me using it and I feel I have to say it’s not mine it’s a Trust one.” (Int B) There were concerns expressed by nursing staff about the device becoming a barrier between them and patients. “it becomes a bit impersonal because the person is there but you’re staring at the screen. But with the paper you’d write something and then be able to put your pen down”. “Yeah you can hold their hand” (FG-B). In these cases staff had developed strategies for this, and admitted to writing paper notes to be typed into the device at a later time but at the same time recognised that this increased their workload and went against the point of having the device.

Most of the respondents reflected on the change in clinical practice related to transparency of data within the clinical setting. “It’s been really good for the nurse coordinating. I can get a feeling if a nurse is struggling…. I can tell if a nurse isn’t getting her obs done then I can ask and they can say ‘I’m actually really busy’ and thats good because before I wouldn’t necessarily have known that their obs were late. It definitely gives us a much safer better overview of the ward." (Int A) This transparency of patient healthstate was also referred to in regards to the software triggering automatic escalations where appropriate and it was suggested by several of the interviewees that this would improve patient safety. Another impact of device use in the ward and reported by two of the interviewees was the communication with doctors “It’s a conversation starter when previously it wasn’t that easy. Especially when you can submit to the doctor and it’s ‘going off’ in their pocket, it’s not that easier to ignore so the conversations happen earlier.” (Int A) The idea that the technology provided a facilitator for communication between nurses and senior doctors was positively viewed by the senior ward nurses as it was seen to empower their teams in the care of the patient when previously paper based working was less effective in regard to this. Whilst it was reported that junior doctors were receptive to the new intervention, it was suggested that there was a mixed response from registrars and consultants and links back to the idea that ‘buy in’ from these senior clinical leaders needs to be obtained prior to deployment.

3.3 Post-deployment of HIT

Following deployment in the wards several themes emerged pertaining to how the technology had embedded itself in clinical work and the future success of the initiative. Concerns were raised by four of the participants about the future continuity of informing patients and their relatives about device use in clinical activities and public perception of this. “I think we are good at it (informing and engaging patients) when we are rolling out but when it becomes the ‘norm’ I don’t think we are so good at it. Its not now, it’s in 6 months or a years time that staff will need reminding of it.” (Int C). This issue was considered by two of the interviewees to be temporary, with staff providing examples of television programmes and retail environments as examples where the technology use would become more familiar to the general public and that “as patients become more used to technology it will become less of an issue”.(Int D)

Paper persistence, the use of written notes to supplement device use emerged as a theme, but was isolated to two acute environments. “I sometimes end up writing things down, especially information about
the stuff of my bay, not confidential stuff but so I know what's required in my area." (FG B) The use of written notes however was largely discussed in relation to communication between clinical teams and how frustrations had emerged where process had been altered following deployment. “It's so frustrating, because we were putting blood sugars on the device but then a few weeks ago the diabetes team said please put the white charts back on the drug cards and put the blood sugar observations on there. So now some people are putting it on there, some people are putting it on paper” (FG B). This lack of consistency and change in process had led to confusion and the perception of additional work where some specialist teams had not fully transitioned to the electronic system.

It was suggested from a range of participants that ‘buy in’ to the system would be improved if the software provided a more comprehensive set of clinical tools, and that the lack of certain resources potentially undermined the use of the system. “It will be good when other things are on here, like the skin bundles. Then you won't need the rest of the paper.” (Int A) It was evident from the interviews that staff do not yet feel that the mobile devices are being used to their full potential, with regard to communication and cascading of information, however there was also acknowledgment that the system needs to be smart and not overload users. “I think there is a desire for everything to be on it right now, but they have to remember its baby steps and other things will be added over time. You can’t do it all at once and overload them”. (Int C) With regard to post deployment support, there was awareness of the need for continued support to the users and this was reflected in the mixed responses regarding the duration of post ‘go live’ support where some felt that seven days was adequate whilst others thought that a longer period would be beneficial (FG A).

3.4 Summary

The following table displays the main themes extracted from the qualitative data set and indicates where within the deployment process they were extracted from.

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<thead>
<tr>
<th>Themes covered in reference to HIT Deployment Timescale</th>
<th>HIT Deployment Timescale</th>
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<tbody>
<tr>
<td>Affective impact of device roll out</td>
<td>HIT Pre-Deployment</td>
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<tr>
<td>Staff anticipation of additional workload</td>
<td>HIT Deployment</td>
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<tr>
<td>Agility and responsiveness of process key to success</td>
<td>HIT Post-Deployment</td>
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<td>Standardisation of information flow and training</td>
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<td>Process management (resources &amp; logistics)</td>
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<td>Early exposure to technology and opportunity for task analysis</td>
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<td>Training requirements and learning</td>
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<td>Technical issues and usability of technology</td>
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<tr>
<td>Sustainability and long term support for staff</td>
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<td>Bespoke Engagement Strategies to address organisational barriers</td>
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<td>Awareness of Initiative, Expectations (Staff PR)</td>
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<td>Staff excitement and enthusiasm for modern working practice</td>
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<td>Paper persistence</td>
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<td>Value of ICT team having clinical backgrounds</td>
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<tr>
<td>Familiarity and use breeds acceptance</td>
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<tr>
<td>Requirements analysis for non-regular wards e.g those with large temporary workforce</td>
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<td>Perceived impact on patient care good vs bad</td>
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<td>Patient and Public acceptance of technology</td>
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<td>Technology as a facilitator for communications</td>
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<td>Identification of informal ‘super user’ or mentor to support ward colleagues</td>
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Figure 1. HIT Deployment Process Themes.
This outline of themes provides a structure for consideration of the issues during the large scale deployment of mobile technologies within the wards of a large complex hospital environment. The themes presented provide insight into the considerations and issues which are important to staff affected before, during and after the technology roll out has occurred.

4. Discussion

The results of this paper outline some of the challenges of implementing new technology systems in complex and busy healthcare working environments and portray these challenges in relation to the stages of the deployment process in which they have occurred.

With regard to the evaluating the impact of handheld technologies on staff practice within ward environments, the interviews and focus groups have provided a rich assessment of how staff have received and coped with the changes in practice instigated by technology. It is evident that there was a degree of disruption to clinical practice and ward management during the technology deployment and particularly on ‘go live’ days. Improved process management and bespoke needs assessment of individual wards may have improved this situation. It is evident that the responsiveness of the clinical ICT team to individual ward needs and their ability to adapt their deployment plan was a significant factor in assisting a smooth roll out of the handheld technologies. Previous studies have suggested that healthcare professionals can be very conservative about new technology use in clinical practice, however this study has suggested that clinical staff can be enthusiastic in their uptake of technology and that is it the planning, management of expectations and provision of support that can help or hinder the process, a finding which is supported by that of Wu, Li & Fu (2011) who state that preparation is key “in enabling pervasive and timely usage without difficulty”.

The study has enabled us to gain a greater understanding of the way in which handheld technology is used by staff. Contributions to the data set from senior nursing staff have alluded to improved situation awareness and transparency within wards which can facilitate improved resource management, clinical decision making, organisation and ultimately patient safety (McBride 2012). This has been emphasised as over time the prolonged exposure to the system has improved acceptance and use of the device and software. Bauer et al. (2008) had similar findings with other HIT systems, whereby familiarity and exposure increased staff utilisation and satisfaction with the technology, however this was not withstanding the perception that the ICT system slowed down the clinical workflow. There was also a perception from staff that the technology and system were not being used to their full capacity. DesRoches et al. (2008) identified a similar statement of need where clinical staff wanted the full IT service rather than a modular system for which functionality and capacity was built in over time.

In relation to reporting on staff satisfaction with regard to the change in technology and practice, there was significant emphasis within the staff data sets about the need for improved PR strategies and their desire to be informed about change in practice and rationales behind the changes. Buntin et al. (2011) highlight the importance of strong leadership and staff “buy-in” if systems are to successfully manage and see benefit from health information technology, a factor which perhaps was not considered enough prior to this case. Additionally, the opportunity to support this aspect and facilitate technology adoption through acknowledging the difficulty of the process, recruiting champions and providing quality and timely training (McAlearney et al. 2014) are proven strategies in previous HIT deployments.

It is easy with hindsight to identify areas of project planning and management and planning which are found to be lacking however these should be framed as opportunities for learning and to provide guidance for future implementation of technology in hospital environments. This project has seen the successful deployment of a large scale ICT initiative in a large secondary/tertiary care teaching hospital. Black et al. (2011) discuss how attention to a mix of socio-technical factors will maximise the likelihood of successful implementation and adoption of HIT’s. Figure 1. displays the emergent themes from the staff experiential accounts of the deployment process, themes which give insight into the elements of the process which impacted their job roles, working practice and use of the technologies. These themes are also categorised into the timeframes for which they are relevant. Some span the entire deployment process, such as the affective impact of the process and devices, building familiarity with the technology and identification of users who can help support others in their adoption of the new system. Others can be considered as loaded at front or back end requirements, where their consideration either early in HIT implementation planning and roll out, or in the latter stages of deployment can have an impact on the sustainability and long
term utilisation of devices. By understanding these needs and concepts and the timeliness of consideration could assist and smooth future clinical ICT projects.

5. Conclusions

The paper describes the experiences of the process of technology deployment in acute ward environments. It evaluates the initial impact of technology deployment and use on clinical staff and their working practices. Evaluation of the mobile technology use in the wards is ongoing and the results from this study have provided evidence to be used in real time to improve working practices with the new technologies.

Although a formal stratified sampling method was not employed due to the constraints of the clinical environment the sample population provided representation of a range of clinical job grades and provides understanding about the adoption and use of technologies by different clinical staff. The themes identified from the qualitative accounts outlines the opportunities and challenges experienced before, during and after the transition to mobile technologies. It is anticipated that the results of this study can inform future technology deployments in hospitals, in particular providing early consideration of the issues which will affect staff experience and clinical working practices.

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