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# A Tale of Two Studies: Evaluating New Technologies in Healthcare

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**Abstract**

In this paper we describe our experiences of evaluating healthcare information technologies deployed in two contrasting hospital settings. We discuss the methodologies that we used for the evaluations, the challenges encountered and how existing HCI research methods may be used for evaluating technologies deployed in the healthcare domain.

**Keywords**

Healthcare, technology, evaluation.

**ACM Classification Keywords**

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

**Introduction**

A hospital is an information-rich environment comprised of distributed information sources that are utilized in varied ways. More than ever before, new technologies are being introduced into hospital settings which fundamentally change the distribution of information and the associated work and pose new challenges for evaluation. This paper summarises our experiences of conducting two evaluations of new technologies deployed in the hospital setting, comparing and contrasting the approaches taken and

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the challenges faced. The two evaluations were designed and conducted entirely independently, in different settings and different healthcare systems, yet there are striking commonalities. We briefly introduce the two studies and then describe the research methods employed and explore the challenges faced.

*Mobile Nursing Documentation (Study 1):*

The first study, undertaken in an acute medical ward of an urban hospital in Canada, evaluated the introduction of computers on wheels to support nursing documentation [1] by replacing paper-based work sheets. Although electronic health records have become prevalent in hospitals to allow distributed access to medical information, they are usually accessible only at stationary desktop computers. In contrast, this new technology provided staff with mobile access to clinical information at the point of care.

*Handover Tool and Interactive Whiteboard (Study 2):*

The second study, undertaken in the medical assessment unit of a large, urban teaching hospital in the UK, evaluated the (simultaneous) introduction of two technologies: a handover tool and an electronic whiteboard. The handover tool was a software application intended for use by both nursing and medical staff to prepare a joint summary of information to be handed over to colleagues at shift change. It replaced earlier, separate handover systems. The interactive whiteboard replaced a non-interactive one and was used to display a summary of key information about all patients on the ward.

**Research Methods**

Both evaluations took place in-situ, using primarily qualitative techniques that are familiar in the HCI

community, but are less commonly applied in healthcare settings. The evaluations were longitudinal, involving more than one point of data collection. In both cases, the evaluations involved the collection of baseline data prior to the deployment of the technology. This proved to be highly valuable as it yielded a rich set of “original” practices that were then used as benchmarks for comparison and contrast with the findings from later periods of data collection. In Study 1, two periods of subsequent data collection were conducted, the first at three months after deployment and the second at eleven months after deployment. The goal was to identify both short- and long-term phenomena arising as a result of the technology intervention. Study 2 involved an initial two week period of observation, to understand the work of the ward, its structures and processes, and to determine the focus for data collection in later phases. This was followed by the baseline data collection and then one subsequent period of data collection, at two weeks after deployment.

Each study used a triangulation of research methods and, interestingly, both studies focused on the information flow and communication among staff. Non-participant observations were the primary method and these allowed us to identify the actions that participants actually engaged in and the phenomena that arose in practice, instead of relying on what participants thought was the case. To complement the observational data, we conducted informal interviews with staff, mostly for the purpose of clarification and elaboration of their actions. These were important for developing a deeper understanding of the complex knowledge work which clinical staff engage in and which is only partially amenable to observation. A questionnaire survey was

also conducted in Study 1 following the two periods of observation, to gather both qualitative and quantitative data regarding staff's experience with the technology.

Finally, both studies examined the information resources, as embodied in various artifacts in the system, the information flows and communication. In particular, we collected artifacts both at the beginning and at the end of a shift. Traces and markings on these artifacts provided good resources for studying how they were used during the shift.

### **Findings**

Study 1 identified a set of problems encountered at the early stage of the deployment of the mobile technology. The later data collection revealed improvements to some of these problems, several persistent and worsened problems and some newly emerged issues that arose over extended use of the technology. These issues spanned over technical, social, health and organizational issues. There was persistent use of the "old-fashioned" paper artifacts which the mobile technology was intended to replace. Comparison with the baseline data suggested that the deployed technology fell short in providing the same kind of affordances that were offered by paper artifacts [1]. Consequently, we generated a set of guidelines for designing technology to support nurses' work practices and information flow based on the role of these paper artifacts in nursing work and prototyped a technology setup based on these guidelines.

Study 2 also revealed the persistence of working practices, with nursing staff remaining as the users of the whiteboard and medical staff failing to take advantage of the electronic whiteboard's potential to

enable them to access additional patient information. While it was hoped that the electronic whiteboard would result in increased awareness of changes in the condition of patient amongst medical staff, this failed to happen due to a mix of technical and social issues.

### **Challenges**

In comparing our experiences of undertaking these evaluations, it became apparent that there were similarities not only in our approaches but also in the challenges that we faced. One challenge that warrants further discussion is how to determine whether or not a technology is 'successful' and how to track that to benefits in terms of patient care. This difficulty in determining success arises in part from the lack of clear objectives for many systems. In Study 2, prior to conducting the third round of data collection, we interviewed those involved in the deployment of the technology to identify what they saw as the anticipated benefits of the technology and how they imagined the technology would be used. This allowed us to explore in our informal interviews with those staff members who actually use the technology the barriers to the technology being used in ways envisaged by the hospital management.

While there were many benefits to evaluating in-situ in terms of understanding real, as opposed to ideal, usage, challenges arose from the lack of control over the situation. If something has changed when we compare later data against baseline data, how can we be sure that it is the result of the technology intervention rather than something else changing (e.g. new staff) in these ever-evolving environments?

Obtaining patient consent was a significant challenge in both settings. In Study 1, the researcher was unable to enter the patients' rooms to shadow nurses and so had to rely on nurses' accounts of what happened. In Study 2, obtaining written consent from patients was a time-consuming task, especially because of the high turnover of patients in the ward. A significant number of patients were unable to provide valid consent, e.g. due to their cognitive status. Such issues, while apparently mundane, have the potential to cripple even the best evaluation plan and therefore should be thought through early on.

Getting staff to answer questions when workload is high can also be a challenge. In Study 1, the researcher built up a good relationship and trust with the staff, with the result that they would tell her or email her about things that happened while she was not there. They also helped to proof-read publications arising from the research, providing an additional form of triangulation. Involving staff in the research in this way, providing them with the results of the studies, helps keep them interested and supportive of the research.

Our experiences demonstrate the value of qualitative data in these settings but the challenges that we have faced also highlight the huge commitment these approaches require. This is an obstacle to the uptake of these approaches outside of the research community. Furthermore, while each evaluation has to be driven by its research questions, the lack of any general approaches or guiding frameworks can also be seen as a challenge. What do we observe? What do we ask? How do we organise and analyse the data? Must these

things be worked out for every study or can we start to draw out common themes?

### **Conclusion**

Several aspects of our approaches in these studies proved particularly valuable and can be generally applied in studies for evaluating new technologies. First, it is important to evaluate against established objectives yet also remain receptive to discovering unexpected outcomes of new technology. Second, we found clear benefits in using a triangulation of research methods to study our research problems. Third, establishing a baseline for future studies provides important benchmarks for evaluating new technologies. Fourth, conducting data collection at different time frames helps uncover short- and long-term phenomena. This in turn helps direct resources to improving desired issues. Finally, examining artifacts at different times provides a convenient way to identify how they are actually used since it is generally time-consuming and labor-intensive to follow participants in order to find out how they use artifacts.

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