Faculty of Design

2013

Negotiating capture, resistance, errors, and identity: Confessions from the operating suite.

Sellen, Kate, Callum, Jeannie, Chignell, Mark and Halliday, Alison

Negotiating Capture, Resistance, Errors, and Identity: Confessions from the operating suite

Katherine Sellen
OCAD University
Toronto, Ontario, Canada
ksellen@faculty.ocadu.ca

Mark Chignell
University of Toronto
Toronto, Ontario, Canada
mark.chignell@utoronto.ca

Jeannie Callum
Sunnybrook Health Sciences
Toronto, Ontario, Canada
Jeannie.callum@sunnybrook.ca

Jacob Pendergrast
University Health Network
Toronto, Ontario, Canada
jacob.pendergrast@uhn.on.ca

Alison Halliday
Sunnybrook Health Sciences
Toronto, Ontario, Canada
Allison.halliday@sunnybrook.ca

CHI'13, April 27 – May 2, 2013, Paris, France.
ACM 978-1-XXXX-XXXX-X/XX/XX.

Abstract
Conducting research in medical settings can pose particular challenges for research on adoption and adaptation to new technologies, especially when medical errors are a subject of the research, or the research necessitates capture of user behaviors and interactions. A case study of research in a clinical setting explores the experience of the researcher as they negotiate the practical challenges of research and research participants' acts of resistance. The researcher's identity, as constructed in the medical setting, serves to make this negotiation more complex. However, this case also illustrates the practical and theoretical approaches that can be applied to overcome these challenges.

Author Keywords
Healthcare; socio-technical; evaluation; context; methods; qualitative; quantitative; ethnography.

ACM Classification Keywords
H. Information Systems.

General Terms
Human Factors; Measurement.

Study Design Details

Site: The operating suites and blood banks of three urban hospitals.

Technology: Electronic Remote Blood Issue system for the issuing of blood units remote from the blood bank for transfusion to patients during surgery.

Participants: Laboratory staff, blood bank technicians, blood bank managers, physicians, anesthesiologists, nurses, porters, and patient support staff.

Data collection: Fieldwork was conducted over three years between 2008-2011, and included collection of qualitative and quantitative user survey data, formal and informal interviews with managers and staff, 6 weeks of observation at each site with 24 hr video capture and in person observation, and analysis of software log data. Access to incident reports, implementation-planning documents, and user feedback and troubleshooting log books, was also available.

Research Focus

Medical settings present a particularly challenging research domain for human computer interaction (HCI). There is increasing evidence from evaluation studies of healthcare information technologies (HIT), that there are significant barriers to successful implementation [1, 5,9] – a gaping socio-technical gap. The aim of the study described in this abstract was to apply HCI approaches to understanding this socio-technical gap by studying changing work practices and human error with the introduction of a new technology solution for releasing blood units for transfusion in operating suites. A secondary aim was to uncover implications for design in safety critical settings.

Study Design

The study utilized a mixed methods approach informed by socio-technical perspectives on HIT implementation and evaluation [2]. The study design is detailed at left.

Study Experience

Carrying out the study was a rich learning experience for the researchers and clinicians involved. Several key experiences are described in this abstract from the perspective of the main researcher and are reported here in a confessional ethnographic style [6].

Challenging Activity Patterns

After some initial meeting with the physician leaders at the three hospitals involved in the technology implementation, I spent a few weeks meeting with staff and looking around the spaces where the technology implementation would occur. I began to realize that studying the adoption of this technology was going to be quite a challenge. The activities that I would be studying did not follow a predictable pattern of working hours but could occur at any time of day or night, they could be once every 45 minutes or once every 7 days, and might last anywhere between 55 seconds to 45 minutes. Added to this was the realization that each hospital had a slightly different case mix and therefore a slightly different pattern of activities. Medical errors of interest to the study might occur once every 6 to 9 months. I realized that traditional ethnographic or observational techniques, either using human observers or handheld video recording, would be impractical.

Thankfully, the implementations at the three hospitals would not occur simultaneously but in sequence. The study needed to be designed so that it did not necessitate the continuous presence of an observer and it worked within a number of other constraints, including:

- Unpredictable start times
- Round the clock activity
- Wide ranging activity durations and frequencies
- Active or moving tasks
- Frequent changes in personnel
- Presence of patients and their significant others
- Security concerns
- Infection control restrictions

I realized that a combination of different data types including log files and video might be useful if we could find the right type of equipment. This could be combined with questionnaires, interviews, and in person observations, to provide context and qualitative insight to the patterns uncovered in the log files and video.

Strategies for REB

Participation: Identify and involve key stakeholders in the research design and in the implementation of the study.

Evidence: Find precedents from published approved studies conducted either in the same institution or elsewhere.

Role-play: Before you finalise the protocol, test out the proposed protocol using role play or scenarios. This will help to uncover unexpected risks and practical considerations.

Demonstration: Be prepared to show the REB the equipment you are proposing and demonstrate the protocols you will use.

Timelines: Build in extra time for unusual protocols or new research designs.

Communication: Make sure your participants and those who manage them are fully aware of the protocol before and during the research.

Video Capture

I started with an Internet search for video capture and discovered some freeware developed as a hacked surveillance system using a cheap webcam for security concerned condo owners. I tried it out in the blood bank of the first site. Positioning the camera and laptop was a problem. It drew a lot of attention from staff. I inadvertently dislodged a ceiling tile that prompted a visit and warning from Infection Control. It became obvious quickly that installing a webcam and leaving my laptop in the semi-public space of the operating suite was not an option. While looking for possible video equipment I chanced upon some surveillance systems for retail stores. The surveillance system used motion sensing and secured encrypted hard drives for storage. These systems were also set up for multiple cameras with different viewing angles (see Figure 1.). This became a key piece of the study and is described in full elsewhere [8].

Approval for Capture

Researchers who report on their research experiences in medical settings often document challenges posed by the medico-legal environment of hospitals. Staff may be resistant to having events captured in detail in case a medical error occurs, the legal department maybe unwilling for errors and near misses to be recorded, and capturing identifiable data must be avoided [3]. The issues of how to inform participants, obtain consent, and manage communication with participants can become a barrier to research [7]. I order to develop an ethical research protocol I conducted a review of published accounts of using video in medical settings. I then summarized this work into a special section for the Research Ethics Boards (REB). The REB invited me to a face-to-face meeting to discuss the study and this gave me an opportunity to show the equipment and talk through the procedures I was proposing. The REB process was lengthy and extensive, including three separate hospital REB reviews and my own home University REB review. I discussed using video with my research partners at the different hospitals. They then talked to their staff members and provided me with feedback about staff concerns. The font line staff managers in the blood banks were key partners in facilitating the use of video. They helped to ensure front line staff were comfortable and ensured staff would be unsurprised when cameras were installed and I started to take notes on their activities. Font line staff managers were also essential for when cameras were installed in the operating suites. I talked to font line staff weeks and then days in advance of cameras being installed, talked over the protocol several times and made myself available in confidence for questions. The response to the use of video was generally positive with some exceptions. I did discover that some nursing staff were disconnecting the video recording devices from their power sources, so I had to keep coming back to the operating suites to check the equipment, after several weeks this stopped happening.

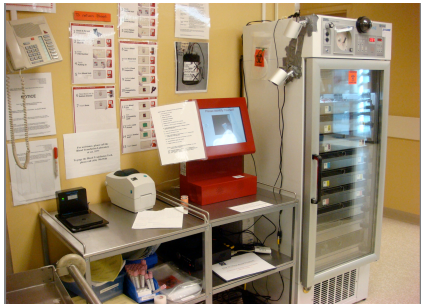


Figure 1. Example of video set-up in the operating suite.

Strategies for Reducing Resistance

Participation: Identify and involve key stakeholders in the research design and in the implementation of the study.

Buddies: Partner with clinicians in day-to-day research activities so that there is always a trusted medical colleague available to help navigate unexpected situations.

Process: Allow extra time for communication with different clinical specialties. Do not expect information to be freely given until you have been in-situ for some time. Allow time for trust to develop.

Outcomes: Be pro-active in identifying research outputs that might be of short to mid-term use by your clinician partners that are not traditional research outputs. These could be consultations for redesign work, usability reports, and communication with IT vendors, or making design recommendations.

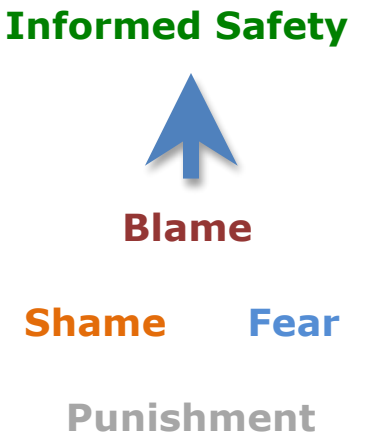
Resistance to Research

One of the challenges encountered in studying human computer interaction in medical settings is the potential for resistance to technology, and resistance to change in general, to transform into resistance to research. I encountered many forms of resistance when carrying out the research activities in the field, including:

- Verbal intimidation
- Suggesting activities that could be harmful
- Spoiling of data collection sheets
- Physical tampering with equipment
- Boycotting research

I will elaborate on two of these. Nursing staff at one of the three sites made a group wide decision not to take part in the questionnaire and interview sections of the study. At a staff wide meeting, where I introduced myself and presented the study, I was questioned by several senior nurses in front of a crowded room. They questioned the need for basic demographic data and accused me of ageism and racism (the questionnaire asked for age range and participants first language). At first I interpreted this resistance to the study as a reflection of the lack of engagement of nursing staff in the development of the research agenda and I started to wonder how I might include nursing leaders in the development of the research. However, I suspected a decision not to participate had been made by the notional leaders of the group rather than senior managers. I decided to sit through the rest of the nursing meeting to see if this was the general style of things or whether this style had been reserved for me. I noticed that the same few senior nurses also dominated other presentations by fellow nurses. The majority of the nurses said nothing. My suspicions were confirmed when the official nurse leader divulged, in a private meeting, that she had no influence on perceptions of the research study by her staff. Separately, a nurse who had attended the meeting approached me. She explained that she had just joined the team from another hospital and understood what I was trying to do, that the research was needed, and that any help they could get to reduce errors should be embraced but that *"the nurses here don't understand, they are years behind".* The group-wide response was clear direct resistance. I still wonder if a more participatory approach to research design could have helped but it is also possible that the culture of this particular nursing group was hostile to change in general.

Indirect resistance was more difficult to navigate. At one site, I was invited by a senior nurse to come with her into an operating room while an operation was in progress. She suggested that I distribute questionnaires directly inside the operating room even though this was clearly against the ethics protocol and would have been disruptive to the progress of the surgery, potentially threatening the patient's safety. This could have led to the suspension of the study at the hospital. I declined her invitation. I began to seriously doubt the design of the study and my ability as a researcher until I was informed several months later, *"We like the new system now, we* [the nursing staff] *were quite upset when it went off line the other day. If you do the questionnaires now I am sure people will fill them in. I can also arrange some interviews for you."*



"they have nurses crying in the corridors too afraid to use the technology in case they make a mistake and too afraid to go back into the room because they will be shouted at."

Figure 2. Quote and conceptual diagram to illustrate change towards a positive safety culture.

I also learnt that the resistance was not only directed at the research activities but also towards the IT department and the blood bank. I observed that the system I was studying was described as, *"blood bank technology"*. Communication was clearly siloed and political differences between clinical specialties played a major role in resistance. At one point a disagreement between nursing and hematology over a JPEG image was elevated to a high level committee at the hospital drawing negative attention to the blood bank and the technology initiative as a whole.

Researching Medical Error

Researching medical error can be a difficult undertaking. I knew from research I had done on using video in other studies that medical error was a sensitive topic for research [3]. However, I was surprised at the depth of reaction to errors and near misses when they did occur. One day on entering the break room I approached some nursing staff at a lunch table. They began to joke *"here comes the FBI".* A nurse sitting alone nearby turned her face to the window when I approached. No one would talk to me. I heard someone mutter a question to another, *"Are we talking about it?" "No. "* came the response. I later learnt from one of the blood bank staff that a nurse had been involved in a serious near miss with the technology that I was studying that same week and the nurse involved had gone on medical leave from stress. Clearly, none of the frontline staff involved was willing to talk about the incident. On a separate occasion while I was visiting the blood bank at another site, my key research partner told me what happened (Figure 2.). I wasn't expecting there to be a hostile culture in the hospitals where the study was conducted but I have since discovered that this is commonplace [4].

A sense of shame and fear of consequences seemed to characterize the conversations about errors that I was able to achieve during the main part of the study. I went to talk to the anesthesiologists at one site about their experience of the new technology. One anesthesiologist remarked, *"I don't know why the blood bank gets so anxious about us taking units out. What's the big deal?"* I explained that the units were not cross matched until the labels had been printed and the units scanned. A look of horror crept over his face as he realized that he had removed un-cross matched blood for transfusion. He looked at the table. He didn't participate in the rest of the session. I realized I had inadvertently exposed his error in front of his colleagues, but I also felt an obligation to explain the potential for serious error to him and his colleagues when he posed his question. I also found myself shielding nursing staff from scrutiny when video footage from the study showed deviations from procedures that could have led to patient misidentification. I adopted a strategy of only discussing aggregate data, describing types of errors rather than specific errors.

I realized that fixing the culture of blame, shame, and punishment in the settings I found myself in was out of scope for the research but that my research activities had the potential to inform safety initiatives if handled in a sensitive way. After several years of working on the study no one had been blamed, shamed or punished as a result of my involvement and so I was able to work more freely on the topic of error, for example, I was given access to error reports, and I was able to provide specific recommendations for design modifications that would enhance safety.

Implications for Researchers

Theory: Socio-technical theory is likely to be relevant in study design and analysis of any in-situ HCI research in healthcare.

Methods: Mixed methods approaches should be considered, and ethnographic techniques, such as researcher diaries, will aid in capturing relevant socio-technical context.

Engagement: Participatory engagement with each clinical specialty in study design may reduce resistance and maximize study success.

Time: REB approval and building rapport can take longer in healthcare settings. Studies with longer timeframes will enable rapport building and trust to develop. Research that touches on medical error will require special consideration.

Identity

In different settings in the hospitals where I have worked my identity is interpreted in different ways and that identity has meaning in terms of status, resources conferred, and data provisioned. When in the operating suite I am usually mistaken for a junior nurse, never a physician or a surgeon. My activities were questioned, my behavior and equipment scrutinized. In the blood bank I am usually mistaken for a medical resident. The lab technicians participate somewhat willingly in the research, but some resent my involvement. I suspect that my gender, age, and what I wear plays a part in this. In the operating suite I am dressed as a nurse but the items I wear do not bear the hallmarks of years of professional practice. In the blood bank I can wear my regular research clothes. I am not encouraged to wear a lab coat and so I cannot be mistaken for a blood bank technician. I have also become sensitive to the role of research in medical settings generally. It would be unusual for a junior nurse or a blood bank staff member to engage in research. This is the privilege of senior physician researchers and medical residents or fellows. Perceived as a junior nurse, I would have no claim to the researcher role.

Conclusion

Just as technology is experienced in situ so is research. The difference in response to the research between the three hospitals reflected the culture and political climate of each setting. This in turn was reflected in the adoption experience of the technology under study. This has practical and theoretical implications for HCI.

Acknowledgements

We thank the staff at each of the three hospitals for their support and involvement in this study.

References

[1] Bardram, J. E. *"I love the system, I just don't use it!"* In Proc. *GROUP 1997*, ACM Press (1997), 251-260.

[2] Berg, M., Aarts, J., & van der Lei, J. ICT in health care: sociotechnical approaches. *Methods Inf Med, 42,* 4 (2003), 297-301.

[3] Gelbart, B., Barfield, C., and Watkins, A. Ethical and legal considerations in video recording neonatal resuscitations. *Journal of Medical Ethics 35*, 2 (2009), 120(5)-125.

[4] Hutchinson, M., Vickers, M., Jackson, D., & Wilkes, L. Workplace bullying in nursing: towards a more critical organisational perspective. *Nursing Inquiry*, *13*, 2 (2006), 118-126.

[5] Jaspers, M. W. M., Peute, L. W. P., Lauteslager, A., & Bakker, P. J. M. Pre-Post Evaluation of Physicians' Satisfaction with a Redesigned Electronic Medical Record System *Ehealth Beyond the Horizon - Get It There*, 136, (2008), 303-308.

[6] Rode, J.A. Reflexivity in digital anthropology. In *Proc. CHI 2011,* ACM Press (2011), 123-132.

[7] Mackenzie C.F. and Xiao Y. Video Analysis in Health Care. *Handbook of Human Factors and Ergonomics in Health Care and Patient Safety*. Lawrence Erlbaum Associates, Publishers, Mahwah, NJ. (2007), 663-678.

[8] Sellen, K., Chignell, M., Straus, S., Callum, J., Pendergrast, J., Halliday, A. Using Motion Sensing to Study Human Computer Interaction in Hospital Settings. In Proc. *Measuring Behavior 2010*, ACM Press, (2010), 297-300.

[9] Zheng, K., Padman, R., Johnson, M. P., & Diamond, H. S. Understanding technology adoption in clinical care: Clinician adoption behavior of a point-of-care reminder system. *International Journal of Medical Informatics, 74,* 7-8 (2005), 535-543