

Observations in a maternity ward: Usability considerations for EHRs in an interrupt driven environment

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Abstract

With the increasing demand on healthcare systems it is imperative that all care is provided as efficiently and effectively as possible. Technology within the medical domain offers an exciting opportunity to augment work practices in order to meet these needs. This research project explores the implications of the interrupt-driven nature of work in clinical situations on documentation within an environment that increasingly involves electronic health records (EHRs). Midwives in a busy maternity ward were observed and interviewed about the work practices they employed to document information associated with patient care. The results showed that the interrupt-driven nature of the workplace, a feature common to many healthcare settings, led to a tension between the work and the work to document the work. Further, the IT environment in which the information was collected was not designed to cater for frequent interruption of the data entry process. Several recommendations for improving the IT environment are proposed to support health professionals in documenting patient data whilst attending to the interruptions. The recommendations include timeout screens, push technology, use of handheld PDAs, and cues to augment documentation in an interrupted session.

Paper Objectives: The objectives of this study were to investigate the impact of the interrupt-driven nature of clinical situations on the data entry of information into a patient's electronic health record. Based on the study, recommendations are made for improvements to the IT environment used by healthcare staff to reduce the negative impact of interruptions.

Background: There is much research relating to notion of a complete Electronic Health Record (EHR) that can be accessed worldwide by both health professionals and the patient (Fitzpatrick, 2000; Hartswood et al., 2003; Reddy, Dourish & Pratt, 2001). Due to the scale of the goal, the EHR is still many years away from being implemented worldwide. The ultimate aim of EHRs is to have patient records that are entirely electronic; physical documents will be a thing of the past. In 2000, the Australian federal government approved the *HealthConnect* scheme to explore the provision of electronic health records (Carter & Loff, 2000). This project aims to provide all Australians with a nationwide EHR that is available to all members of the healthcare team and the individual concerned. Two years of research into the viability, value and appropriate model for delivery for *HealthConnect* have been completed. The federal government has allocated another five million dollars in the 2003-2004 budget for further usability testing, integration with both existing and planned clinical information systems, and also further research into security measures regarding electronic data transfers (DHA, 2004).

There are many issues to consider when discussing the introduction of EHRs. Whilst not exhaustive the following areas give an indication of the complexity of the situation. The price of implementing a system is significant. The Australian government allocated \$37 million for a two-year period for research and development of *HealthConnect* (DHA, 2001). *HealthConnect* is estimated to have initial implementation costs of \$300 million over a 10-year period; annual running costs of \$160 million; and potential annual savings of \$300 million. These are all dependent on the registration method used and the infrastructure choices made for *HealthConnect* (Mount, 2003). For the successful introduction of EHRs, issues relating to privacy, confidentiality and security (Haugh, SX2004; Lim, 2001; Ueckert & Prokosch, 2002) must be addressed, providing both healthcare workers and patients' confidence in the system. In particular, when dealing with electronic records,

disaster recovery plans (Peglar, 2003) and data integrity (Hammond et al., 2003) are areas that require special consideration. When dealing with individual's personal information, ethical considerations (Stanberry, 2000) are of the utmost concern. A combination of legislation, institutional policies and technology will provide a strong foundation to address these concerns. The above-mentioned issues are of vital importance for the implementation of EHRs. This paper, however, is focused on the implications of entering the data for the staff that provide patient care in an interrupt-driven hospital setting.

As Fitzpatrick (2000) suggests, in order to successfully introduce any new technology to support work practices, the "richness and complexity" of the work practices must be understood. This is in accordance with the recommendation of Contextual Inquiry as the first step in the optimal redesign of a work practice, using a customer-centred approach to understand the real day-to-day work practices (Beyer & Holtzblatt, 1998). This principle influenced the design of the approach for this study. Field visits and interviews provided detailed information relating to actual work, allowing a deeper understanding of the complex work situation. Research conducted within a small office agrees that "the importance of understanding the 'real-world' conditions of work" (Rouncefield et al., 1994) is essential when considering redesigning work practices with the introduction of technology.

For clinical information to be incorporated into EHRs it needs first to be collected and then entered into the "system". This research focuses on current work practices of the "staff at the coalface", who deal with clinical work and the related collection and documentation of information. In adopting this focus, we are interested in the use of both paper and digital documentation and how they are used. Throughout the research, we followed Hughes et al.'s (1997) framework for computer-supported cooperative work (CSCW), which presents data from workplace studies into themes consisting of: awareness of work, plans and procedures, and distributed coordination. One issue in particular which arose out of our study was the interrupt-driven nature of clinical work. This phenomenon has been documented elsewhere in other non-design contexts (e.g. Coiera & Tombs, 1998). How people deal with interruptions in everyday settings such as this is significant for designers of new technologies to be used in such settings.

Methods: We followed a "quick and dirty" approach (Hughes et al, 1994) to inform our understanding of the setting, based on field observation, interviews and informal conversation. Sparse field notes were taken during conversations and fleshed out from memory. Audio recording was also employed, amounting to two hours of selected interviews and conversations. The informal interviews were conducted individually in interview rooms to maintain privacy and confidentiality. This was to ensure that the participants felt that they were free to say anything without being concerned about what their supervisor or other colleagues may think.

The setting. The study was conducted in an antenatal/postnatal ward within a busy maternity unit (1785 births in the year 2003), at a Level 2 hospital in the South-East Queensland metropolitan area, Australia. The unit comprised of an Antenatal Clinic, Birthing Suite, Level 2 Special Care Nursery and the maternity ward, with specialist maternity staff in each area. The research was conducted on the maternity ward which consists of 30 beds plus a 4-bed swing ward that is shared between the maternity and paediatric wards as required according to patient numbers. The number of staff on each shift was dependent on the number of patients, the amount of care the patients need and the shift in question, i.e. typically a morning shift will have a higher midwifery staff per patient ratio than a night shift.

Nature and number of participants. The participants in the study were midwives employed by the hospital and worked within the maternity unit. Staff members in the unit were multi-skilled and able to be deployed within the unit. The research was conducted on the antenatal/postnatal ward, with the choice of the participants determined by the level of work experience on the ward, i.e. no new

casual or graduate staff inexperienced with the subtleties of the working environment were interviewed.

The first author carried out the field visits and had twelve years of experience as a nurse and midwife, five of which were at the hospital in which this study was conducted. The researcher had informal conversations with five midwives of varying seniority before conducting individual interviews with two midwives, both of whom have been at this hospital for at least two years.

Time and length of study. Five field visits were conducted over a two-month period. The flow of information and the physical and digital documentation relating to patient care were noted.

Within that timeframe, multiple visits were conducted. During the field visits samples of physical and digital documents in use were collected, staff were observed during the documentation process and discussion with nursing staff both in a small group and then several one-to-one informal interviews were conducted. The final visit was to ensure that the resulting understanding was an accurate reflection of the situation.

The work process. Typically the work consists of providing nursing care to mothers and babies during their stay and then discharging them, either home or on the Early Discharge Program (EDP). To support this care, many instances of documentation occur throughout the mothers' stay. During the stay the most important documents for the mother and baby are their respective clinical pathways. Each situation has an assigned clinical pathway, for example a vaginal or caesarian delivery, and describes the care and progression expected in an uncomplicated hospital stay. Accordingly, these documents drive the care provided by midwives and are used as a working tool throughout each shift, with midwives signing each section after providing the prescribed care.

When a mother and baby are discharged multiple documents are employed. The physical documents include clinical pathways, inpatient progress notes held in the medical records, Personal Health Record book and if going on EDP, the discharge interview. Where a Neonatal Screen Test (NNST) has been collected, it is also documented in the NNST Nursery Book. The digital documents that are accessed for a discharge are Obicare, Trendcare, Hibiscus (HBCIS) and the ward bed list.

Results: From the interviews and discussions with the midwifery staff some common themes became evident. Firstly, it was discovered that they tend to write information about certain events too many times. They also indicated that there are too many computer applications that they have to interact with to complete their work for each shift.

The idea that the documentation process takes longer than the actual nursing care provided was raised by one of the interviewees:

Quite often I sit there and think it's taken me 5 minutes to do the NNST and 15 to chase up all of the different places I'm expected to write it in.

This clearly shows the frustration that is felt regarding the documentation process that is followed on the ward, taking the staff away from the care of the patients, which is what they feel their primary task should be. Currell et al. (2003) discuss this perception of staff whereby documentation of care is something "that takes time to complete, which might otherwise be spent at the bedside".

The work levels are dynamic within the maternity unit. There is no level of certainty regarding the amount of work that each midwife will experience over a period of a shift due to the nature of the job. As a result, midwives tend to complete as much documentation work as possible whenever they have a chance. This is illustrated by a midwife's comment when asked about the order in which she documents a discharge:

Depends on the day, like the two that I am sending home today. I've already done their discharged Obicare. They haven't been seen by the Doctors yet, but I'm pretty confident that they are going ... we can always change the date on Obicare to when they go, so I have already done that while I was quiet this morning.

The midwives don't have set times to complete "paper" work so they take advantage of whatever time becomes available, allowing them to deal with the unexpected, if and when it happens, later in the shift. What time is available isn't always enough to complete certain documentation without experiencing interruptions as illustrated by a comment by a midwife referring to Obicare documentation:

Or you sit down to do it on the computer, and someone says, can you come and check this drug or can you go off and do this, so you tend to not actually be able to just sit there and put everything in, so you come back and have lost your train of thought.

Interruptions not only mean that the process of recording information takes longer due to the actual time away from recording the information, but also that the cognitive effort increases as the staff have to remember their place/stage within the documentation process or what information they were going to enter.

It was suggested by a midwife that the length of time it takes to complete a discharge on Obicare is dependent on both the individual's experience with Obicare and the completeness of the information already entered from previous events, with her average time estimated to be 20 minutes. This may not be an unreasonable time period to be interruption free when the ward is relatively quiet, but when the ward becomes busy midwives expect that this documentation time will be interrupted.

Discussion and Implications: Documentation is a necessary component of nursing care to facilitate dissemination of information. For any documentation process to work effectively it needs to consider actual nursing practices, the information itself and the ultimate use of the information. From a nursing point of view the requirements for success are solutions that support nursing practices and augment patient care.

The suggestions proposed here relate to the current work practices on the maternity ward and endeavour to reduce the duplication of effort and to minimise the effect of interruptions while entering information.

1. Implement an 'active timeout' screen for applications. Due to the interrupt-driven nature of the work environment it is not uncommon for it to be necessary for midwives to leave the computer before completion of information entry. In these situations there is the possibility that applications can be left open and unattended, leading to potential breaches of privacy. To enable the correct use of audit technology for privacy and confidentiality of patient records Conner (1999) recommends implementing "a 'time out' if not used within a specified time". A simple timeout, however, would become frustrating due to the frequent loss and subsequent re-entry of data. Applications should therefore allow staff to actively suspend data entry when they are interrupted so that they can return to the task when time permits. An active timeout such as this would allow staff members to 'lock' the data entry while dealing with an interruption, and as a consequence allow other staff access to the workstation and application. Consideration would have to be given to the increased risk of open records left uncompleted at the end of shifts.

2. Utilise push technology to get information to desired places. The introduction of EHRs offers the opportunity to use implicit input for automating data entry into the record. Where data is entered by hand there exists the possibility for mistakes, especially in a setting where interruptions can act as distractions from the task at hand. Direct or implicit entry of data arising out of patient care

activities using so-called ‘smart’ appliances would remove some of the documentation effort required. For example, smart scales could be used to weigh babies. Each baby could have a unique smart tag that can be read by the scales, when the baby is then weighed the midwife can press a button that sends the baby’s information and the weight, date and time to the system avoiding the need for the midwife to enter any information into the database. Not only would this remove one possible site for error, but it will also create more time for the patient care that is the ‘real’ work. Further, once the information has been entered into the database system in this way, push technology would direct it to all relevant authorised entities elsewhere in the health authority.

3. Use of handheld devices to make digital information portable. The use of a handheld device (e.g. Personal Digital Assistants or PDAs) would reduce the constraints placed on midwives in relation to entering information. Current constraints relate to the number of accessible computers with the appropriate software installed and also the placement of those computers. In the maternity ward, two of the three computers are located in a recessed alcove in the corridors—this means that there is less privacy than the computer located at the nurses station, there is the potential for extra disturbances, especially during visiting hours, and there is less desk space to layout physical documents that are being referred to for the information. A handheld device such as this would offer similar affordances to physical paper documents with respect to mobility, privacy and convenience.

4. Implement cues to augment digital documentation in an interrupted session. Due to the interrupt-driven nature of the work environment it is common for a midwife to be disrupted while entering digital information. Mimicking the cues afforded in physical documents, e.g. bookmarks, being able at a glance to see what has been documented previously, to-do and done piles of folders would improve the current digital documentation procedures. Cues could be implemented using:

Colours—green for completed sections within the digital document while red indicates incomplete sections.

Icons—representing an inbox with the number of sections yet to be completed are indicated by the height of the “pile”. This could be implemented in conjunction with the colour system.

Shapes—full shapes indicate the section complete, empty shapes indicate the section has yet to be commenced, while shapes partly filled indicate that the section has partially been completed.

In summary, this research has been concerned with the phenomenon of the interrupt-driven nature of work within a medical domain. To illustrate the existence of this phenomenon a short study was conducted on a micro-domain level within a maternity ward. Field visits and interviews with midwifery staff were conducted to establish an understanding of the work practices and how current technology supports these practices. This ethnographic study of the problem area was used to inform proposed solutions for the micro-domain.

Whilst the specific context of the maternity ward may place a limit on how far the findings can be generalised, the recommendations are based on user-centred research and as such have a good grounding as a starting place. They also replicate similar findings from a study of a training centre office where similar tensions between the ‘real work’ of customer service and the work to document these activities existed (Rouncefield et al., 1994). Further research is needed to validate the proposed recommendations. This could be completed with a focus on the micro-domain level of a maternity ward in a different hospital, a different specialty area, for example the emergency department or a surgical ward, or even focusing on documentation within a nurse manager’s domain which has no direct contact with patients. Another interesting area to consider may be hospitals from different states in Australia. Further research would indicate whether or not the recommendations are general enough to implement and be useful in other areas or only appropriate for a maternity ward. This may be the case as generally speaking mothers and babies are healthy and require little traditional nursing care, therefore the documentation required will be very different to documentation within a surgical ward.

Finally, it should be noted that the Obicare system referred to in this paper was cancelled after the study was conducted. At the time of writing there is a state-wide working party which is considering the next step towards EHRs. In the light of this, the recommendations reported here can be seen as indicators of areas requiring attention so that future implementations of EHRs can function more effectively in interrupt-driven settings such as the maternity ward in this study.

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