Impacts of Technology Deployment on Information Assembly and Disassembly during Shift Change

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INTRODUCTION

Shift work is indispensable in the healthcare sector and it relies heavily on effective information transfer across shifts to ensure patient safety. The shift change activities are essentially collaborative work that achieves communication of information and coordination of work activities [5]. The information communicated during shift change influences the delivery of care for the entire shift and the overall quality of healthcare extended to patients.

Electronic health records (EHRs) have been increasingly replacing paper medical records to provide for better integration, information sharing and smoother collaboration among different healthcare services [3]. Hence a thorough understanding of end-users' needs is vital for the successful design and adoption of the EHR systems [1].

Medical practitioners are often required to spatially move to seek information for providing appropriate patient care. Therefore, if EHRs can only be accessed at stationary information points such as desktop computers, information sharing is then limited to the designated locations defeating the potential benefits of real-time sharing of information at the point of care, which might best provide patient-centered services and improved resource utilization. Therefore, mobile technology has become a common research theme that investigates if, where and how communication may be improved to offer timely information, e.g., [2].

In our study ward, wireless computer-on-wheels (COWs) were introduced simultaneously with a new patient care information system as a means to offer mobile access and sharing of patient information. This technological set up is part of an intervention project intended to improve the quality of healthcare services that had been planned before we started our research on this ward.

TECHNOLOGICAL INTERVENTION

Our previous study [4] focused on the basic practices of information flow during nurses' shift change. We identified a variety of information media, interplay between common and personal information spaces, information content types and functions as well as the information assembly and disassembly processes involved during shift change [4].

Figure 1: (a) Nurses gathered in shift change room before using COWs (b) Nurses prepare their shift "alone" inside the computer terminal after adopting COWs (c) An outgoing nurse charting at a COW.

The introduction of the COWs prompted us to conduct a short observational study to explore how the shift change practices had been influenced by this technological change. We were indeed privileged to be allowed to observe in the early stage of technology adoption during the time that our participants were still experiencing difficulty, as typical in most adoption periods, in adapting to the new technology. Thus, it is not unexpected that undesirable impacts may be observed and negative comments expressed. Yet, we believe that this observation may shed light on how technology design may be improved.

For our study, we used minimally-intrusive observations, informal interviews and examination of the information documents in use. The COWs deployed consist of a desktop computer running on a wireless network positioned on specially designed ergonomic trolleys (Fig. 1c). The technology is designed for a less-paper environment in the short term and for a paperless organization in the long run. Therefore, the traditional paper-based patient care summaries that had been printed out at the start of each nursing shift for use during the shift were no longer in use. While the use of COWs in another hospital indicated that they freed nurses from mundane retrospective reporting so they have more time to spend with their patients [6], our observations revealed otherwise. We also observed several other unanticipated impacts influencing the shift change practice which may directly affect task performance during

their shift. However, it is expected that nurses will acquire new experiences to adapt better to the technology over time.

RESULTS

The study reveals that the introduction of the technological setup influences several aspects of the shift change practice. We give a brief overview of the issues faced by nurses, highlighting the continued, but unanticipated, use of paper artifacts as a means to coordinate shift work.

With the technology intervention, EHRs can be accessed through the COWs which are typically parked along the ward hallways (Fig. 1c), desktop computers inside the computer terminal (Fig. 1b) and along the ward wings. Although nurses are expected to directly interact with the mobile wireless COWs for information access and entry at point of care without using intermediary artifacts, all nurses we observed prepared *paper-based personal notes.* They carry and use these notes during their shift as an immediate information source and intermediary notepad. They all commented that the COWs cannot replace their personal notes which allow them to easily find information they need. With the paper-based patient care summary being abolished, nurses no longer gather inside the shift change room (Fig. 1a). Many nurses expressed that they *missed the rich social interaction* that used to take place with their colleagues inside the shift change room. Rather they now only concentrate on the computer screen in front of them. A nurse commented, "very often I felt so lonely, it's like um' I'm the only one here… I don't like it…" Since the EHRs do not provide overviews or summaries, nurses have to in principle read the entire record which undoubtedly takes considerably *more time.* This is aggravated by the large number of finely specialized categories of information residing in specific windows in the new information system such that *heavy mouse manipulation* is necessitated to access required information. Meanwhile, conventional computer hardware poses another *difficulty to right-handed people* who have to frequently switch their dominant hand between mouse manipulation and writing. This again increases the preparation time and augment the *muscle fatigue*. All nurses require more time with the new system; several even need twice as much time as before. Consequently, outgoing nurses *seldom post shift report* on whiteboard, which is still in use, for their next shift. Instead, most of them resort to *verbal reports only*. While the COWs offer mobility, nurses actually felt *more distant* from their colleagues because they are all scattered over the ward wings and they are too busy with the information system that they hardly find time for social interactions. A nurse commented, "if they're to design something, why can't they design somethin' that can help us work, not to make it harder for us to work!" While one nurse does always bring the COW into the patient room and enters medical information directly to the EHR without first transposing to her note sheet (she still keeps a personal note of important medical information as reminders), all other nurses said they rarely bring the COW to the point of care because of its *awkward ergonomics* and its *inflexibility* for use as an interaction surface. Another issue that further hinders nurses' work is the COW's *battery life* which is often found too low to be operable and required recharging. "Recharging the COW is not a priority of my job!" Moreover, the COWs run on power-save mode so that the system will be automatically turned off after a couple of minutes' idling. This proves a considerable challenge for nurses when they are preparing medications for their patients. The monitor serves to display medication information while nurses prepare them for their patients. The frequent system power-off compels nurses to subconsciously rush their work trying to complete the preparation in order to avoid having to repeatedly login the system. This likely will lead to *suboptimal patient care*. In addition, the considerable increase in time that nurses must spend at the computers brings out other issues that were not as pronounced before the implementation of the new technology. One such issue is the seating comfort, more appropriately *seating discomfort*, caused by the high wooden stools (Fig. 1c). Many nurses reported that they frequently suffer from severe back pain that forced them to call in sick. This unfortunately exacerbates the *nurse shortage* problem experienced in the local health region.

SUMMARY

Medical practitioners in our study ward are expected to go paperless in the long run as the wireless COWs potentially allow mobile medical information for sharing in real time. However, our observations indicated that the COWs currently suffer problems when compared to affordances offered by paper-artifacts such as flexibility, portability, interactivity and support for social practices. Thus nurses still prepare and rely heavily on their personal notes as their immediate information source and as coordinating artifacts between the point of care and the digital information system. While some of the difficulties such as preparation time encountered in the early adoption stage may well improve over time, other impacts such as right-handed issue and battery life may require other interventions.

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