Healthcare Quality and Information Flow during Shift Change

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Abstract. This paper presents the preliminary stages of an observational study that is intended to guide the design and development of technologies to support information flow during nurses' shift change. There is not sufficient understanding of how the complex information sharing processes take place during the nurses' brief shift change in a hospital setting. Furthermore, we do not yet know what technologies will be appropriate for supporting such an intensive flow of information. We will conduct an observational study in a hospital ward to acquire an understanding of the processes, practices and mechanisms currently used to support information transfer during shift change and expect to develop a set of design implications for the design of collaborative groupware to support the information flow during shift change.

Keywords: shift change, information flow, information assembly, information disassembly, handover, technological support, observational study.

1 Introduction

Communication within medical environments is ubiquitous and accounts for a substantial part of healthcare practitioners' daily routines, encompassing interactions in varying contexts and information sharing across temporal and spatial dimensions [1][6].

As we move into the 21st century, medical care is making increasing use of technology and medical records are now largely digital. However, the handling of medical information is often still a mixture of mental recollection, handwritten notes, large charts on white boards, verbal reports, digital records and printed records. In this period of shifting media usage, the task of information exchange that nurses are faced with during shift change is perhaps unnecessarily complex. This is in part due to the fact that the technology in use was probably initially designed for office use, with only the software specifically designed for hospital use.

Our research addresses the question of how to design technology that can better support the task of information exchange and fit more seamlessly and less obtrusively into the working environment.

We will start by observing how tasks are currently performed, in order to acquire insights into how technology should be designed to support these activities.

Therefore, our first step is to conduct an observational study in a hospital ward to understand how communication takes place between nurses during shift change, what practices are used, what artifacts are employed, and what problems nurses encounter while seeking the information they require.

2 Background

Clinical handover is a fundamental practice in medical settings to transfer medical information across shifts and is an essential aspect of health care delivery [9]. Shift work relies heavily on effective information transfer to ensure patient safety. The information communicated during shift change influences the delivery of care for the entire shift and the overall quality of healthcare extended to patients.

A literature survey report on clinical handover and patient safety prepared by the Australian Council for Safety and Quality in Health Care in March 2005 showed that *"ineffective handover can lead to wrong treatment, delays in medical diagnosis, life threatening adverse events, patient complaints, increased health care expenditure, increased hospital length of stay and a range of other effects that impact on the health system"* [9]. Missing information, distractions, and lack of confidentiality, such as no privacy at nurse's station or patients' relatives in close proximity, were reported to be the top three problems identified during nurse shift change [8]. We therefore focus on the basic practices of information flow during nurses' shift change and on how technologies can help improve the efficiency and effectiveness of the information flow processes. We chose to study nurses instead of general clinical shift work, as nurses are at the frontline of patient care, spending most of their working hours with patients. The information they obtain during shift change directly impacts the quality of care provided to patients.

Popular handover methods used during shift change include patient's bedside handover, audio-taped handover and handover conference [8][9]. Handover, in whatever mode, provides the opportunity for nurses in consecutive shifts to communicate important medical information, such as patient's diagnosis, vital signs, diagnostic tests and restrictions, and to ensure the continuity of patient care [9].

3 Shift Change Communication

Our research interest is in the specific communication practices in use during the fundamental and important information flow during nurses' daily shift change. In order to provide the best possible healthcare to patients, nurses working in different shifts must work collaboratively to ensure all the tasks pertinent to patient care are carried out properly. This is also why efficient and accurate flow of information between nurses in consecutive shifts is so important. However, the temporal, and sometimes spatial, separation between information senders and recipients makes shift work difficult, as the separation (temporal and/or spatial) prevents them from discussing and clarifying the interpretation of the information in transit [6].

In practice, some of the shift change activities may happen synchronously (i.e., nurses of consecutive shifts may meet during an overlap period between their shifts to effect the information flow), while some occur asynchronously. For example, information flow often happens through mediating artifacts such as a whiteboard and/or notes and records since nurses do not often meet during the overlap period. From our preliminary observations, the latter is the predominate mode of information flow processes in the hospital ward where our case study is being conducted

4 The Study

This particular ward, the Ward of the 21st Century (W21C) in which we are performing a detailed case study, is a uniquely designed hospital ward with two principal goals: *"to create a novel hospital-based physical infrastructure that would provide opportunities for creating health care solutions in the broad spectrum of internal medicine… and to create a novel research environment around this new infrastructure"* [5]. We are conducting an intensive observational study to investigate the current work practices of shift change in the ward. We are interested in how their work is organized, how it is carried out, how it is managed, what intermediary artifacts are used and how it can be supported by technology.

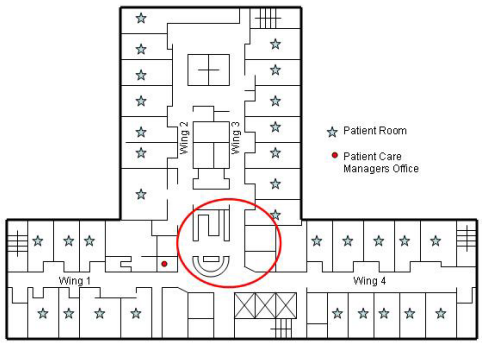
To obtain a thorough understanding of the current work practices, a minimally-intrusive observational study of information flow during shift change in the ward is underway, combined with some video capture and analysis, interviews and questionnaires to acquire insights into how technology should be designed [10]. The empirical data so obtained will be analyzed qualitatively with a goal to design a groupware prototype to support the information sharing processes. There are several sub-goals: (1) to identify the categories of healthcare information required to properly carry out the collaborative tasks; (2) to identify the artifacts used for information flow and how they are used; (3) to articulate the problems people encounter while seeking the required information and identify the areas that technology can support the information sharing processes; (4) to investigate the mobility issues of nurses during shift change while seeking/providing required information from/to nurses in the previous/next shift.

4.1 Existing Technology

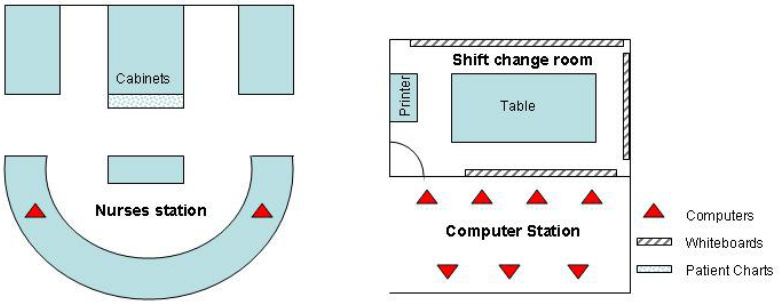
Figure 1 shows the layout of the ward in our case study. While some shift change activities such as face-to-face communication between nurses of consecutive shifts may occur inside patient rooms or along corridors of the four wings in the ward (Figure 1a), most of the shift change activities take place in and around the nurses station, the shift change room and the computer terminals (Figure 1b).

Currently, information to be assembled by an incoming nurse to a shift is distributed over paper-based, verbal, displayed and digital sources (Figure 2, left). These sources are: (1) paper-based patient care summary and patient chart containing laboratory and diagnostic results as well as written consults by physicians; (2) verbal

handover from nurse of previous shift and instructions from the charge nurse; (3) displayed patient information on large whiteboards and notices addressing the nursing staff; as well as (4) digital patient records. Nurses at the start of a shift often seek information from all or a subset of these diversified sources, consolidate and customize pertinent medical information as personal notes in different formats. For example, most nurses write down notes as personal reminders on a separate note-sheet to help them carry out their tasks during their shift (an example is shown in the middle of Figure 2) while others write in the patient care summary which is a printed abstraction of the electronic patient record. In addition, incoming nurses may also be required to seek medical information about ancillary services provided to their patients such as specialists (e.g., neurologists or cardiologists), social workers or physiotherapist.



(a)



(b)

Figure 1: (a) Floor plan of the Ward of the 21st Century (b) Layout showing the nursing station, shift change room and computer station as circled in the floor plan above.

Similarly, as shown on the right of Figure 2, current routines at the end of a shift to disassemble information assessed and gathered during a shift include communicating with consults via the patient charts, verbally reporting to the next-shift nurse and to the charge nurse, posting medical information on large whiteboards inside the shift

change room, and reporting detailed medical information to the digital medium which then ascribes to the patient care summary.

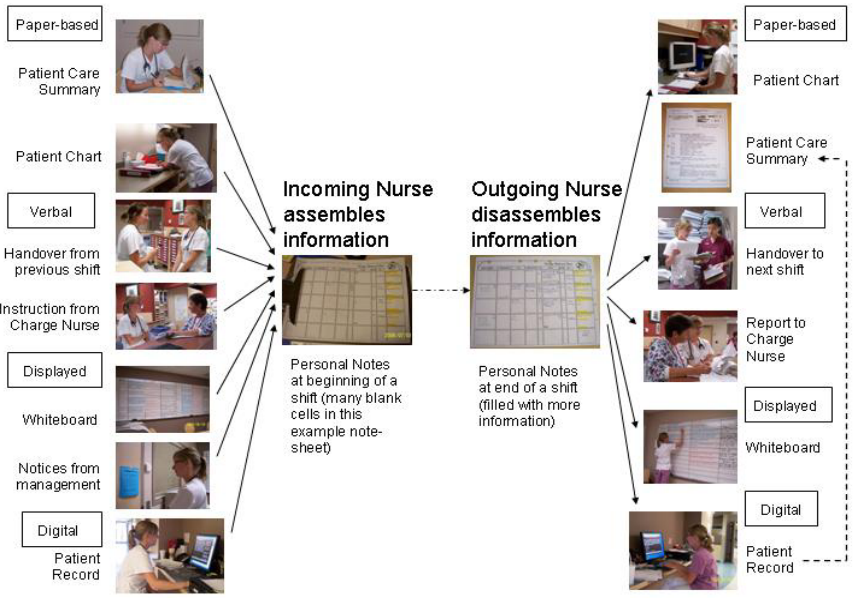


Figure 2: Information assembly and information disassembly during shift change

These information assembling and disassembling activities may be performed in varying order depending on the preference of individual nurses on duty and the availability of concerned personnel. The bottom line is timely retrieval of critical medical information is crucial for the provision and continuation of quality healthcare to patients.

4.2 Challenges

The process of information assembly by incoming nurses and information disassembly by outgoing nurses during shift change is no straightforward task. It is complex because (1) it involves a variety of media: paper-based, verbal, displayed and digital sources; (2) these media sources are distributed over different locations such as the shift change room, the nursing station, the computer terminals and the four wings in the ward; and (3) the information disassembly and information assembly takes place almost in parallel within a brief time period. Spatial movements across different information sources and subtle temporal coordinations are therefore required to ensure that information is available at the right place and at the right time.

Currently, coordination artifacts used for the collaborative shift change activities in our study setting include large whiteboards, patient charts, patient care summary reports, patient records, and personal notes. These artifacts may be public, semi-

public or private. By public, we mean the artifacts that are visible to the general nursing staff, e.g., large whiteboards, while private artifacts are strictly for individual use, typical examples are the personal notes prepared by nurses themselves. We consider artifacts semi-public when they are accessible by the nursing staff but are typically accessed by only a sub-group of nurses based on patient assignment, such as the patient care summary, patient charts and electronic patient records.

While the coordinating artifacts readily emerge, the specifics of the information exchange activities undertaken are still largely unknown in terms of how exactly the information is shared and how effective the current processes are for supporting the collaborative work. This includes understanding what information is communicated, how artifacts are currently used and interacted with during the information flow [3], what problems nurses face during the information flow, and in particular, how they cope with the breakdown of information flow. We will also investigate the local mobility required for effective information flow [4].

With the multiplicity of information-carrying artifacts involved during shift change, it is not surprising that redundancy may exist while complementary artifacts together provide for comprehensive information. We are thereby interested in investigating if and how such redundancy should be eliminated [7] and how thorough information through complementary artifacts can be upheld.

In addition, we observe the more subtle actions that take place during shift change. For example, we want to see the facial expressions of nurses posting medical information, are they confident, or do they appear doubtful; we want to find out what has happened in response to a sigh or a disapproving head-shaking; we also want to find out what artifacts (e.g. personal notes) are used and how many times they are referred to during a end-of-shift report. Our goal is to design and develop a technology prototype appropriate to seamlessly supporting the practical activities and actions that take place during shift change.

4.3 Technology Design

Since diversity and widely spatially distributed information sources are involved in the information assembly and disassembly processes during shift change, computer technology may have a good potential to improve the situation by replacing and/or supplementing some existing technology with technology that may offer a more coherent and comprehensive information hub.

It may be premature at this point to design technology to support the practical work during shift change, but we have been considering viable options. For instance, large digital boards may be a good candidate to replace the whiteboards inside the shift change room so that nurses do not have to leave their work or patients in order to post the latest medical information for use by their next-shift nurse. Medical information can also be more coherent and centralized for retrieval and distribution through computer networks. From our observations, personal notes are indispensable artifacts for nurses in carrying out their job. We therefore consider that technology should allow nurses to customize medical information in their preferred format. We also consider embedding the information processing devices into the environment more naturally and casually [2]. For example, latest medical information, including the

upcoming medicine administration list, of assigned patients will automatically be transferred to the nurses' handheld computers as soon as they enter the shift change room.

5 Evaluation

While the prototype system will be based upon the observations from our study and understandings gained from existing literature, we have yet to find out how such a system will influence the information sharing practices of nurses during their daily shift change. It is no easy task to perform an evaluation to investigate the impact of such technology on information sharing processes. While a study in a simulated environment may not truly reflect what actually goes on during shift change, it is also not feasible to deploy the prototype system in a real setting where patient safety may be compromised. Therefore, we hope to get feedback on how such an evaluation can be carried out so that we can find out the true impact of the prototype on supporting the information flow without compromising the patient safety and the quality of healthcare provided to patients.

6 Conclusion

Effective information flow during shift change has an important impact on the provision of healthcare to patients and it is of paramount importance that information is shared accurately during shift change.

Despite the fact that we are still vigorously collecting data on how and what information is currently communicated, what artifacts help effect the information sharing, what problems people encounter with the existing system and what mobility issues are involved, we expect to present an initial set of implications on technology design to support information flow during shift change in the workshop.

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