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The Cognitive Work of Nursing

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Abstract

To build effective and sustainable health care systems, the design of these systems must be informed by an accurate understanding of how healthcare workers do their jobs. We show how we used this technique to develop requirements for a mobile decision support system for telephone triage. Finally we discuss the opportunities and challenges inherent in applying CWA to the design of healthcare systems

Keywords:

clinical nursing research, nursing models, psychological models, clinical decision support systems

Introduction

In this project, we explored the design of a mobile healthcare system for cardiac nursing coordinators (NCs). We began our design process phase by looking at the cognitive work of the NCs. We used an approach called Cognitive Work Analysis (CWA) for this phase of the project. From the CWA we developed information requirements that guided our design. We found CWA to be a useful tool for understanding cognitive work in a healthcare context.

Method

We followed the CWA approach of Vicente (1999) and used the phases of work complexities, task analysis, and strategies analysis. We did not perform a complete five analysis CWA. While a full CWA would provide a richer picture of the work of the nurses, the three phases were chosen strategically to maximize the information needed to provide effective decision support.

We used structured interviews and a case recall approach with nursing coordinators at the Ottawa Heart Institute.

Structured interview

We interviewed all the NCs using a predetermined question set. We did allow the interviewers to probe the NCs for more information at the interviewer's discretion. Our questioning process concentrated on the following elements:

- Were different strategies used for different types of patients?
- How do they accommodate initial conditions (e.g. patient's most recent surgery) in their subsequent strategy?
- How do they probe for information and what comparisons or references do they use to understand that information?
- At what point do they develop concepts or mental models?
- How do they perform differently with straightforward calls compared to more complex or difficult calls?
- Following the structured questions, the interviewers were allowed to probe opportunistically. The probing was to determine:
    1. Strategy differences between nurses
    2. Strategy differences by type of patient or condition
    3. Complex relationships that could benefit from decision support
    4. The differences between expert and novice nurses

Case recall

We asked the NCs to generate a number of typical calls representative of the types of calls that they receive from cardiac patients who have been discharged from hospital. The sequence was not constrained in any way and the NCs were able to answer freely. Twenty-five call types were generated.

The objective of the case recall was to develop best practice question algorithms for commonly seen cardiac symptoms.

Results: cognitive work analysis

We discuss the results of the CWA in three phases, the examination of work complexities, examination of tasks, and examination of strategies.

Phase 1: work complexities

The first phase of a CWA looks at complexities in work caused by features of the work environment itself. The objective of this analysis is to extract information requirements and to develop an understanding of complexities in the work. By complexities, we are looking for challenging problems to solve and tight relationships between different

factors. As these are identified, they are then explored further.

Specific work complexities that we examined through this analysis were:

1. Medications and their effect on patient health
2. Pain assessment
3. Patient care timelines

Phase 2: tasks

The tasks phase looks at sequences of tasks, task allocation and hand-offs between people, and various modes of operation.

Modes

Two clear modes were apparent, one mode for cardiology patients who were patients in cardiac treatment not directly related to a recent surgery, and cardiac surgery patients, who had recently had surgery.

Task allocations

Analyzing task allocations revealed that there were multiple decision makers in this environment. The first decision maker is the patient or their designate (usually a family member), who has direct experience with their condition, can monitor it regularly, and must at some point make the decision to call the NC for additional advice. Decision making is then allocated to the NC who can proceed to assess the patient further and make a recommendation, or in some cases, contact a physician for further advice. The final decision maker is the physician, who is contacted on a smaller number of more complicated cases.

Task sequencing

We focused on the sequencing of the nursing tele-triage task. Most nurses begin in an observational phase, often asking an open-ended question or letting the patient describe the situation. Their first decision is an assessment of the severity of the patient's condition, i.e. should the patient move to an emergency facility immediately, or should they proceed to describe their condition. If the patient is not in acute danger, the nurse may proceed to follow one of several questioning strategies to extract more information from the patient. These observations are used to make an assessment of the patient's condition and formulate a recommended procedure or action for the patient.

Phase 3: strategies for efficient work

We identified strategies from our semi-structured interview process and responses to typical questioning scenarios. We observed that NCs may ask open ended questions, may work from a standardized question list, may question for symptoms topographically, may build a hypothesis of the situation and test for confirming or refuting information, or may use a strategy of deliberately ruling out possibilities.

Discussion: requirements for design

The following list provides a summary of how each analysis phase contributed to our understanding of cognitive work. More importantly, each contribution maps to a specific design requirement.

CWA Phase: work complexities
Information on medication and side effects, pain assessment points, timeline points

Design requirements:

1. Medication reference

2. Pain assessment visualization

3. Timeline visualization

CWA Phase: Tasks
Teletriage task support, connection to patient and physician, support for cardiac surgery and cardiology modes

Design requirements:

1. Distinct modes for cardiac surgery and cardiology

2. Task stage support with support for observations and guidance

3. Information exchange with physicians

CWA Phase: strategies for efficient work
Multiple types of parallel support. support for mnemonic memory tools, standardized questioning patterns, hypothesis testing and rule out, topographical search

Design requirements:

1. OLDCAR support (onset, location, duration, characteristics, associate symptoms/aggravating factors, and relieving factors)

2. Decision trees with standardized questioning

3. Body topography mapping

4. Hypothesis test and rule out visualization

Conclusion

CWA developed a rich set of information requirements and led to the successful design of a tool that was flexible and able to support multiple tasks. The approach is unusually fruitful in generating design ideas. The support system that was developed and the results of the evaluation of the system are available in Momtahan et. al (2007) being presented at this conference.

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