
Evaluation of a Medical Note Creation Prototype for Physicians in an ICU

Lauren Wilcox

Department of Computer Science
Columbia University
New York, New York, USA
wilcox@cs.columbia.edu

Steven Feiner

Department of Computer Science
Columbia University
New York, New York, USA
feiner@cs.columbia.edu

Abstract

Evaluating novel interactive technologies for physicians in hospital settings poses new challenges to HCI researchers. Over the past year, we have been working with attending critical care physicians, residents, and nurse practitioners in the New York Presbyterian Hospital (NYPH) Cardiothoracic Intensive Care Unit (CTICU) to design a novel software application for creating patient progress notes. We have used different types of evaluative strategies at different research phases. Beginning with ethnographic observation and proceeding to user-centered design iterations, prototype creation, and a qualitative user study conducted at NYPH with ICU physicians, we have noted key considerations for evaluation at several stages of the design, development, and study of our prototype. We wish to share our experiences and insights gained, and learn from others how to identify and overcome challenges in evaluating novel interactive technologies in hospital settings.

Keywords

Medical user interfaces, interaction techniques, interactive systems, evaluation

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Creating daily patient progress notes is an important task for physicians in a hospital Intensive Care Unit (ICU). These notes serve multiple purposes. First, a note ties together relevant and important patient information that is scattered across different sources (e.g., laboratory reports, examination results, prescription drug orders), creating a comprehensive view of the patient's current status. A physician's assessments and plan for the patient are based on this integrated view of multiple data sources. Second, a patient note serves as the primary source for current patient status when multiple healthcare team members communicate with each other. Finally, a patient note is included in the patient's official medical record for legal and billing purposes.

Despite its importance, current tools and applications available to ICU physicians do not adequately support the creation of patient progress notes. Most Electronic Medical Record (EMR) systems can integrate relevant patient information from multiple data sources, but have form-based or template-based interfaces for entering physician notes. These systems are designed primarily to support billing and legal record-keeping, rather than to support the note composition processes of physicians, whose primary mission is patient care, not documentation.

We analyzed the current note creation practices in two ICUs at New York Presbyterian Hospital (NYPH), using observation, semi-structured interviews, and a survey.

We found that most physicians were concerned that predefined forms and templates restricted and impeded their ability to express observations, assessments and care plans of patients under their care. They desired a flexible, free-form document editor for composing the patient note, augmented with domain-informed patient data assistance for providing relevant patient information to insert into a note.

Based on our findings, we engaged these physicians in iterative design sessions and developed a medical note creation prototype that provides intelligent, interactive data assistance with integrated, user-controllable data retrieval, updates, and alerts. We then performed a qualitative study of the prototype with 15 physicians in two NYPH ICUs. Our analysis of this study will help us refine our prototype further. Each step of our research involved an evaluation process in which effective communication with physicians helped to define and measure outcomes and formulate next steps. In the following sections, we elaborate on key considerations we discovered and challenges we faced in conducting our research in an ICU environment.

Evaluation in Early Design Phases

Task Analysis

Designing new technologies for physicians in an intensive care unit incurs several challenges for HCI researchers from the outset. When posed with a high-level task to support, many researchers first seek an understanding of the context of the task, the users' goals in carrying out the task, and the current methods, techniques, tools, and systems for performing the task. They spend time upfront observing the specific target user group, and their interactions and workflow to shed light on task analysis. We found that

conducting extended observations in the CTICU did give us a sense of high level workflow, subtask sequences and particular interactions, but our lack of domain knowledge made it difficult to make sense of our observations of physician context and workflow.

Our strategy for better understanding our observations was to engage physicians in semi-structured interviews early on in the design process. We alternated between non-interactive shadowing, and intensive question-answer sessions. To determine how to focus our questions to attending critical care physicians, we focused on residents first. We asked them to explain the steps in their mechanical processes, clarify terminology, elaborate on their thought processes, and explain high to low level aspects of their tasks. We also asked them to compare and contrast these processes and tasks with those of the attending critical care physician.

Attending critical care physicians had only minutes to answer questions between responses to critical patient events. Since these physicians have limited time to spend offering explanatory descriptions of their tasks and goals, it was necessary to strategize how to engage them without interfering with their delivery of care. After gaining insight about specifics of their tasks from residents, we formulated an extended interview plan, with prioritized questions that we estimated could be answered within a few seconds to a few minutes in brief intervals whenever we had an appropriate opportunity.

Patient Information

Although the proliferation of online medical references, vocabularies and standards is helpful in making sense of patient data, researchers still encounter problems

when faced with the variety of schemas in disparate databases. Legacy data entry systems that lack sophisticated error checking may accept erroneous entries without offering sufficient means for detection and correction. When working with data during implementation of our prototype, we secured several residents and two attending critical care physicians as points of contact to direct questions to in order to clarify the role and meaning of different patient data entries.

Prototype Design

Once we had established an understanding of the specific tasks for which we would design support, we continued with a user-centered, iterative design approach for a novel note creation application. We found that allowing the physicians to determine design outcomes and guidelines was most appropriate, although it required a long period of outcome formulation and verification.

While determining aspects of the visual design, layout, and details of the interaction techniques for our prototype, we included a few residents in sketching activities and low fidelity prototype feedback sessions. Most physicians found such sessions frustrating. They did not have time to take advantage of the flexibility and creative capacity of these approaches and disliked having to associate user interface components with drawn and/or paper representations.

We found that we gathered more physician feedback and evaluative comments by presenting higher fidelity, shallow user interface demos upfront, asking the physicians questions about the specific components and interaction techniques we demoed. Physicians preferred

to accept or reject design choices that they could see as a digital artifact, resembling a final version of software, even if all of the proposed functionality was not included. However, when the designs demonstrated were not to their liking, they did offer sketches of “their versions” of specific aspects of the design.

One remaining challenge for evaluating designs in this phase is the inclusion of varieties of usage scenarios in a higher fidelity prototype. Another is scale of patient information included in a higher fidelity design: a proposed interaction technique for patient information charts may be reasonable and a physician may approve of such techniques given the scope of data shown. However it is important to demonstrate different scales of patient information, with realistic and varied patient data profiles in mind (e.g., a patient on 20 medications as opposed to 5). Accounting for varied profiles in a higher fidelity prototype may increase production time, but will yield more realistic feedback.

Study Design Evaluation

Once our prototype was ready to support the creation of a sample patient note assisted by retrieval of patient information, we faced several challenges in designing a user study to evaluate the prototype. Conducting a study within the realities of a hospital ICU posed several constraints. While physicians were willing to participate in our study, most are on call while at the hospital, and could only spare about 30 minutes of their time. We needed to plan a training session, task, and survey that could be completed in no more than 30 minutes. Since we were at risk of interruptions from cell phones and pagers during our study, we opted for qualitative feedback during and after use of the system rather than quantitative timing metrics to compare

throughput with their current process. Designing the study instruments to convey a realistic study scenario and elicit structured feedback required extensive collaboration with hospital staff.

Future Work

We are now considering conducting a controlled study to elicit comparative data between notes created with our prototype system as an experiment condition and notes created in the traditional manner as a control condition. There are many considerations that must be addressed in the design and evaluation of such a study. If each attending physician is to be compared against him or herself, what period of time is adequate to explore their use of each condition? What are the potential confounding factors involved in such extended use of both systems? In addition to verifying the accuracy of raw patient data in a note, should the clinical quality of the remaining portions of the note be evaluated? If so, by whom? What statistical models are most appropriate for such an evaluation?

If our metrics indicate a decrease in the demand on physician time in writing the note, can we show that this decrease transfers to an increase in bedside time with the patient or increased time spent teaching residents? Would interviewing residents and nurses about possible changes in attending physician availability be worthwhile?

By attending this workshop, we hope to learn from fellow researchers about these and other issues related to the evaluation of interactive technologies in hospital settings.