

User Interfaces for Computer-based Patient Records

A CHI 98 Workshop

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Introduction

The CHI 98 Workshop on User Interfaces for Computer-based Patient Records was organized as part of this year's healthcare track. The goal was to bring together people working in the area of clinical information systems to discuss the very difficult design challenges involved.

The primary purpose of computer-based patient records (CPRs) is to keep track of clinical data about patients and share this information with the wide variety of healthcare professionals who interact with patients. Traditionally, this information has been kept in a paper record, and paper-based patient records have evolved throughout this century to a highly successful format with critical information and processes encoded in the structure of the paper records. However, paper-based records have had some severe limitations, for instance: bulkiness, time delay in obtaining records, and the necessity of redundantly entering many types of information. As one workshop participant noted, "it's hard to support clinical decision-making with this big pile of paper".

By computerizing these records, CPRs offer the potential to reduce these problems with paper records while potentially saving time and money, improving patient care, and improving overall job satisfaction for clinicians. In the process, CPRs have quickly grown far beyond being simply computerized versions of paper records and are being used throughout the hospital setting for record-keeping, staff coordination, treatment planning, decision-making, billing, and many other applications.

CPRs are extremely complex systems involving large numbers of users with large volumes of data, and requiring high reliability, security, and performance. Their design therefore confronts usability experts with a significant challenge and offers the opportunity for important lessons that can be applied in other complex settings.

Workshop Overview

This one-day workshop brought together 16 participants from diverse backgrounds, including physicians, nurses, researchers, developers, and designers. We had experience with systems ranging from research prototypes to large-scale production systems. This diversity led to differences in focus and priorities, but nevertheless we found that we shared most of the same concerns.

We began the day with presentations of our position papers. We then opened discussion to identify significant usability concerns, and finally spent focused time discussing two broad issues: 1. customization, and 2. navigation and data visualization.

Design Challenges

During individual presentations and the discussions afterwards, we identified many issues in the design of CPRs that we'll divide into design challenges and design guidelines. The challenges reflect recurring problems with no simple solutions that this field is likely to continue to face, including the following:

- complexity of design and the large number of requirements

- lack of practical standards
- the wide diversity of users, settings, and applications
- information overload
- system performance limitations
- training time limitations
- multi-vendor environments
- understanding clinical workflow
- trust and authentication of users
- data presentation and visualization
- organizing information and showing relationships
- data entry techniques

In addition, there are a variety of pragmatic challenges to actually getting user interfaces to continue to improve:

- limits to the sharing of information between companies
- the disruption caused by updating systems at a pre-existing site
- the long feedback loop in getting new design ideas into products
- risk aversion by developers
- implementation and integration problems

Design Guidelines

These are some of the primary user interface guidelines that were suggested:

- Make it fast! Clinical users are severely time-constrained.

- Access data, not widgets. Use a large display and display the data compactly to show the maximum amount of data possible.
- Provide links to relevant medical knowledge.
- Primary users must be clinicians, but support all healthcare professionals.
- Facilitate rapid assimilation and analysis.
- Provide value beyond paper records.
- Eliminate redundancy — identify relevant data.
- Prevent errors and oversights.
- Consider the entire workflow.
- Provide summary data and input of the data in the same view.

Customization and Flexibility

One of the big challenges in the design of CPRs is the need or perceived need for customization of the user interface to the needs of a particular hospital or user. Hospitals and physicians frequently have their own unique processes, and the economics of clinical information systems is such that they can make demands to have their customizations included. However, this creates an incredible difficulty for designers and developers, and can add significant complexity to the user interface, as well as introducing unexpected problems for users.

Some frequent things that users may want customized to their particular needs include: favorites lists, font sizes, colors, personal order sets, treatment protocols, priority variables (main variables to display for a particular patient), event sets and filters, and various views of data. Which of these are simply optional user preferences settings, and which are essential features of a clinical user interface?

In some cases, customization may improve productivity or improve the

quality of clinical decision-making. However, only a few empirical explorations have been done into these possibilities, and getting more of this data is critical. Customization may also degrade productivity, for example, when two users are unable to communicate effectively because data is displayed to them differently. Another concern is that users may be able to customize their user interface in a way that actually degrades their performance without realizing it. As designers, we'd like to make sure that customization is only provided when it is actually a benefit, but we will need further empirical data to address most of these issues.

When customization is provided, we need to make sure:

- it helps experts but doesn't confuse novices
- the customizations are persistent across sessions with the system
- the customizations are mobile with the users, since most clinical users will have to work with multiple workstations
- customizations are associated with users, not workstations, since multiple users may be sharing a workstation at different times
- confusions between two users are avoided (e.g. the color red shouldn't be able to represent a "safe" value for one user and a "danger" value for another, if this could lead to misinterpretation of displays)

Navigation and Data Display

Another primary design challenge that was discussed in detail is the question of how to best display and navigate patient data. Small data sets are relatively easy to view and navigate; large data sets present challenges. Healthcare software frequently innovates in the types of input devices used in accessing these large data sets, and in addition to the standard mouse and keyboard, speech and pen interfaces are often used or at least explored.

One way to view data that was common to several presentations was the use of graphical timelines, which seemed to be a useful view but which becomes problematic with extremely large data sets as with other displays. Some options were to show sorted, filtered, or hierarchical data sets. The choice of exactly which type to use may depend on the data, the task, and the platform being used to browse. Even when we choose to sort, filter, or organize the information, how do we select effective filters or classifications schemes?

Where do we go from here?

Several participants expressed the need to explore these issues in much more depth. In particular, the topic of user interfaces in healthcare systems does not have a good literature review available. Similarly, a review of current products would save a lot of time in reinventing solutions, as would a reference of typical approaches to common problems. Participants also expressed a need to make developers of clinical information systems aware of the importance of these pressing user interface concerns.

UIHealth Mailing List

Participants wanted to continue discussions of user interface issues in healthcare information systems, and we created a mailing list for this purpose. Anyone may join the mailing list discussions by sending a message with the subject "subscribe" to:

UIHealth@UsabilityFirst.com

When you subscribe, a help file will be returned with full instructions for using the list.

Workshop Website

Additional information and all the workshop position papers are available on the workshop website at:

<http://www.diamondbullet.com/cpr/>

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