An Investigation on the Use of Computerized Patient Care Documentation: Preliminary Results

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Abstract

We report results of a pilot study on the use of the Department of Veterans Affairs (VA) computerized patient care documentation system by three stakeholder groups: doctors, nurses, and administrators. The study is informed by the Cognitive Work Analysis methodology. Results identified both benefits of using the system as well as limitations. Based on these findings, design recommendations will be developed and validated in a larger follow-up multi-site study.

1. Introduction

Adopting Electronic Health Record (EHR) systems has long been a challenge for health care delivery organizations. Progress in "computer-izing" health care organizations has been hampered by technical factors such as lack of universal patient identifiers and user resistance to employing standardized terminology, but the biggest barrier has been providing adequate support for the complex and cognitively demanding workflows found in health care. Over a 25 year period, the U.S. Department of Veterans Affairs (VA) overcame enough of these difficulties to implement an EHR which supports all care activities in a national network of hospitals and clinics that cares for millions of veterans. No health care organization of similar size has matched this progress [1].

The VA's EHR has been in extensive use for ten years, affording important unanticipated lessons. This paper focuses on a single aspect: computerized patient care documentation (CPD) functionality. CPD is defined as the portion of the EHR that supports capture and retrieval of narrative text required in patient care: the progress notes, reports, and discharge summaries found in medical charts. As of October, 2005, 740 million documents were stored in VA databases [12]. Preliminary investigations of VA's CPD have revealed issues that other health care organizations will likely face when they fully implement the EHR, along with similar consequences on system performance and usability [8, 9, 23, 24, 25]. This investigation is part of a larger VA research effort to attain deeper understanding of these problems, their sources, and possible solutions from the EHR user's perspective.

1.1. Goals and objectives

Our study is a pilot component of a VA Health Services Research project seeking to define "information value" as found in clinical documents and understand threats to the accuracy and efficient processing of information. The goal of the parent study is to refine and clarify previously discovered themes in the VA CPD experience and investigate how various stakeholder groups use CPD in the EHR to complete their work tasks. To serve this goal, our pilot study had three objectives:

1. Interview and observe VA practitioners, nurses, and administrative staff during work activity and analyze user-system interactions.
2. Identify patterns of use and instances when participants experienced difficulties hindering their work.
3. Develop a mock-up prototype with improved functionality in observed problem areas.

The prototypes will be used as stimuli for discussion in planned user focus groups.

1.2. Background

The VA's EHR development effort began in 1977 [11]. In 1982, the VA nationally adopted a "Decentralized Hospital Computer Program" which supported administrative, lab and

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pharmacy systems and had some basic EHR functions. By 1994, a text based system incorporating order-entry functionality was available, but not widely adopted until the advent of a graphical user interface (GUI) version in 1997. This became known as CPRS (Computerized Patient Record System). The GUI version improved data access and navigation between functions. A graphical text editor facilitated wide adoption of provider order and narrative text entry. The on-screen presentation of the CPRS was deliberately fashioned to resemble a traditional chart, with tabbed sections for labs, orders, notes, consults, etc. The first VA hospitals became "paperless" in 1999. By 2002 all 162 VA hospitals had followed suit. Later versions of CPRS supported image storage and retrieval and remote access to data at any VA facility. Commercial paperless EHR systems are currently being deployed, but most healthcare practices still utilize paper documents [4]. The VA's extensive experience with CPD offers an opportunity to study the consequences of implementing electronic documentation.

Some of the consequences of adopting electronic documentation were anticipated in earlier research on the human-computer interface. Reading a screen is 40% slower than reading paper [15]. Nygren's comparison of paper and electronic records noted the "skim, skip and stop" tactics of skilled readers, the loss of tactile cues in electronic records, [16] and the consequent importance of consistent formatting and pattern cues to reading and processing speed. [17]. Powsner, et al. anticipated potential problems with interface design, and discussed a host of "system problems" likely to accompany computerization, including the tendency of trivial documentation to accrue, difficulty finding relevant textual data and the negative influences of hasty implementation strategies and inattention to user training [19].

VA investigators have begun to identify difficulties in computerized documentation that stem from the ways groups of workers use systems over time, rather than from specific flaws in user interface design (although these flaws persist). A study of use of copy and pasting revealed that 10% of patient electronic charts contained at least one instance of copying judged likely to contribute to a medical error [9]. Another study demonstrated how copying introduced factual errors into the medical record [24]. A study of user impressions of computerized documentation revealed that users expressed concerns that the requirement to spend time at computers documenting care resulted in less effective staff to staff communication [7].

2. Methodology

Work-centered design methodology is concerned with designing technology that supports and enhances people's daily work practices [6, 20]. Work-centered design views the workplace holistically by looking at the total work domain culture. It studies workers' activities and tasks, taking consideration for workers' goals and priorities, how they share information, and their personal procedures and routines. Work-centered design methods assume that technology compatible with established work-place culture is ultimately more useful to workers and helps them complete work more efficiently.

Work-centered design contrasts with traditional system-centered design approaches [10]. It also contrasts with approaches to system design derived from cognitive psychology because such approaches are limited since they look at how people process information without consideration for the social context in which the technology exists [6, 14]. Work-centered design theories attempt to incorporate concerns about workers' sociality.

2.1. Cognitive Work Analysis

Our study is informed by the Cognitive Work Analysis (CWA) conceptual framework for work-centered evaluation and design [20]. This framework has been developed as a general approach to help information system designers analyze and understand the complex interaction between (a) the activities, organizational relationships and constraints of work domains, and (b) users' cognitive and social activities and their subjective preferences during task performance [22]. The framework is the result of generalization of experiences from field studies that led to the design of support systems for a variety of modern work domains, such as process plants, manufacturing, hospitals, and libraries.

The CWA work-centered approach to the evaluation and design of information systems assumes that information interaction is determined by a number of dimensions. To facilitate an evaluation, a framework for cognitive work analysis is constructed. This analysis addresses dimensions such as: task situation in terms of work domain, decision making, and mental strategies that can be used; the organization in terms of division of work and social organization; user characteristics, resources and values. Each dimension is analyzed according to four abstraction levels: goals and constraints, priorities, work process, and physical resources.

CWA in health care is not new. For example, over the past fifteen years the methodology has been used in the design of clinical displays, clinical information systems, medical equipment, and modeling intensive care unit patients [6, 7, 14, 20, 22, 24].

2.2. Subjects

Subjects were recruited from three key stakeholder groups that use the documentation system extensively: independent practitioners, nurses, and administrative staff. Eleven subjects participated: 4 administrators, 3 nurses, 2 nurse practitioners, and 2 physicians. One-on-one meetings with subjects were conducted at VA Puget Sound facilities in Seattle and Tacoma.

The study was approved by the University of Washington Institutional Research Board and interview subjects gave informed consent to participate.

2.3. Interviews/Observations

Meetings were conducted when patients were not present. Subjects were asked to describe their work tasks and discuss how they interacted with the system, what information they needed when reviewing CPD, and what strategies they used. A semi-structured interview script addressed four CWA dimensions:

- Goals and constraints: Goals associated with work roles and barriers and trade-offs encountered while pursuing them.
- Priorities: Prioritizing work decisions in the face of workplace constraints.
- Work processes: User behavior required to acquire and analyze information and then to make decisions and take actions while using the system.
- Physical resources: Tools in the EHR environment utilized to accomplish the work.

Immediately following the interview, users were observed interacting with the CPD component of VistA CPRS using a "think aloud" process, to point out their needs and strategies as they interacted with the system.

These interviews and observations lasted between 30-60 minutes. All were audio recorded and transcribed. The transcripts were then subjected to thematic text analysis.

3. Results

The interviews of the three groups of users yielded a rich set of subjective and observational data. Some of the patterns of observations appeared to cut across roles, and others were more role-specific. A content analysis, developed from authors' reading and discussion of the transcripts permitted clustering user impressions of the documentation system into a preliminary, practical classification scheme. User comments about the system behavior were classified as denoting either:

- Benefits – features of the system which users liked, facilitating their work with record review and input.
- Problems – deficiencies of the system which users felt were partially handled or could not be addressed by the system.

Examples of participants' comments illustrating these points are presented below.

3.1. Benefits

Through interviews and observations, there were a number of features users identified in the system as useful and were well-liked. These are noteworthy because they not only described what the user liked, but also suggested how certain problems might be addressed. Below are features users brought up, grouped into three areas of functionality.

3.1.1. Record review. The key benefit users cited were features which allowed them to review CPD easily.

Despite the transfer of information to an EHR, people treated CPRS much as they did a paper medical record. Tabbed section dividers permitted rapid navigation between topic screens when browsing for information. Users found the top-level interface familiar and easy to adopt.

Sample quote: "All aspects of the system: progress notes, discharge summaries, lab data, radiology reports, consults, surgeries…anything that's contained in the health record that I would need in order to get the information that I can use."

Specific features users identified with respect to record review included:

- Auto filters displaying pre-specified titles of interest in boldface aided document browsing, though filters were not always used effectively (see section 3.2.3 with respect to custom filters). *Sample quote: "For example, my medicine notes, all the medicine notes, are highlighted/bold – the titles are highlighted – so I can go through and pick them out."*
- Selectable filters to sort records into groups (e.g., signed and unsigned), or by author.
- Links, an exception to standard browsing, permitted jumping to relevant text in the record. This was featured in alerts and in the "cover sheet" section, and appeared to be a beneficial but underutilized feature. *Sample quote: "So, under this screen [cover sheet], any consults pop-up here – these are my alerts. And, if you click on [the alert], you can process the info right away from there, instead of going and finding the patient – it takes you straight over there [to the consult]."*
- Quick overview of the patient was a key benefit noted numerous times. Features which facilitated this included the cover sheet, laboratory, and medication tabs, and the ability to pull specific patient data from the clinical data base into a note being created. *Sample quote: "This [progress note] pulled it [text] from a data source that I asked to have included."*
- Remote Access allowed users access to CPRS data sources from other facilities in the VA national network. *Sample quote: "...pull up where the remote data came from and then I would go in and select what I wanted – and that will give me information from other VA's around the country."*
- Up to date data provided timely information for treating patients, though this was not always the case (see Constraints below). *Sample quote: "...right away it would tell me if he's service-connected or not. And that makes a big difference as far as disposition as well. So that's good to know right there."*

3.1.2. Record input. In addition to patient data review, numerous benefits related to CPRS data input processes were cited as helpful in reference to CPD functionality. These included:

- Computer Provider Order Entry [CPOE] requires that all consults be ordered. This enforces a single point for input, retrieval and tracking of consultation documents. *Sample quote: "...all of the consults go through the CPRS system."*
- Smart tips provided contextual information at the time of input, aiding the user with helpful tips based on their tasks. This functionality, currently only available to administrative staff for coding assistance, appeared to have potential application in the clinic by practitioners and nurses. *Sample quote: "I know that's where I want to be, so I click enter, and it says "transfusion of packed cells" and that's what I want there, so it brings it over, any smart tips I need to know about that code, things to help me out with…and it brings me over to this coding screen, and I say "yeah, that's what I want."*
- Template use, although a concern (see section 3.2.2) with respect to template *mis*use, provided several benefits. Templates reduced typing, provided a means to quickly insert medical data, and encouraged standardized notes in a format familiar to others on the healthcare team. *Sample quote: "This is a pre-made note, of things that I say often, so I don't have to type it all the time…and then I edit it to make it pertinent to the patient basically."*

3.1.3. General comments. In general, users had favorable opinions about the VistA CPRS. Among features users favored included:

- Accessibility of data, with information in (mostly) one place, data is highly accessible and VistA CPRS is strongly supported by its users. *Sample quote: "...get the information in what we'd consider a more timely manner. It enables the nurse and every other practitioner to streamline the information, perhaps use less words, and that means use less time on the record and more on-hands patient care... I think it's easier for everyone else to obtain the information, because you don't have to enter writing – there's no writing to interpret."*
- Alerts appeared helpful and informative, and even under-utilized in the opinion of some practitioners. Alerts do interrupt workflow, but can serve as useful reminders and are often used for communication between members of the healthcare team. *Sample*

quote: "It helps to get alerts to saying this was completed, as a reminder to you – I put in this consult, and I need to follow-up on it. But on the inpatient also when you have 20 patients on your service, it helps to get the alerts back."

- Display ergonomics in VistA CPRS offered some enhancements such as ability to adjust font sizes. *Sample quote: "I'm going to change the fonts here, so that I can read it better."*

3.2. Problems

There were also many deficiencies users identified in the system. These were broken down into further categories – limitations, constraints, and barriers – to address the nature of the problem and their varying degrees of difficulty.

3.2.1. Limitations. At times, when users felt the CPRS could not address certain needs, the complaints appeared to be outside the scope of the current system.

These problems related to the basic difficulty of supporting a complex and often uncertain endeavor such as health care with information tools. In general, these limitations had no simple digital solution, and would unlikely be rapidly resolved by modifications in the design of the information system. Such limitations included:

- Computer and network errors causing the system to fail were discussed during the interviews and occurred on a few occasions during observations. Users generally treated these as acceptable, even expected events, and moved on. *Sample quote: "program locks up, freezes, and I have to shut-down to access it again…hopefully it will work this time!"*
- Human factors cannot be addressed adequately by technology alone, but require solutions outside of the digital realm. From individual freedoms and user preferences to organizational policies and healthcare culture, these intangibles are difficult to address – especially given the exception-filled domain of health care. *Sample quote: "as practitioners, unless it's mandated (like you won't have your job), practitioners aren't going to…"cookie-cut".*
- Information overload in healthcare has been well-studied [3] and appears to have been accelerated by copious storage capacity and an apparent norm of documenting "anything and everything" in CPD. Despite the fact users complained about how seemingly unnecessary some documentation was, they nonetheless accepted it as required charting. *Sample quote: "All these consults, they get buried in the notes section – the progress notes. Everyone writes a progress note – the nurses write 2-3 notes a day; the physicians write, if they're in the hospital, they write at least a note a day; PT, OT, everyone who has something to do with the patient writes a note!"*
- Physical environment itself prevented the widespread adoption of EHR in many situations. These included a highly mobile environment, resource limitations on hardware, and the limited amount of time available to practitioners to sit in front of a computer. Furthermore, despite most records being in VistA, this was not always the case. Again, users simply accepted this limitation. *Sample quote: "Sometimes, I have to draw out of the VistA system. Sometimes, I have to go to old-fashioned hard charts and copy paper (laughs)!"*
- Systems setup and the integration of different technologies is seldom smooth – problems here included integration of third-party software used in chart coding, VA developed projects (e.g. VistA Imaging), integration of legacy paper records and external resources (e.g., the Department of Defense EHR). Users accepted changes and improvements as being gradual and worked around these limitations, moving from one software package to the next. *Sample quote: "When the new version came out in 2002-2003 – we got this new thing – the new one will tell me if we've done anything since 2002. If the question is if I did something prior to that, then I have to go back into VistA."*

3.2.2. Constraints. At other times, users felt CPRS was constrained in what it could do, and system use did not sufficiently handle issues.

Many of these problems related to underlying database design, operational factors, and improper configuration of the user environment. These appeared addressable but not necessarily easily fixed and included:

- Accuracy of information was often questioned because the system's enforcement of record maintenance was unpredictable. For example, the problem list appeared to be frequently outdated. Because of fear of inaccuracy, medications and other lists were almost always double-checked. *Sample quote: "Cover sheet's not always accurate…things don't make it from the progress note."*

- Data sorting of the record had many exceptions leading to trouble finding specific information within the chart. For example, bronchoscopies would appear in a progress note but not in the reports or consults tab – such exceptions simply had to be learned by users. *Sample quote: "all the procedures – let's say a echocardiogram, cath reports, or lower extremity duplex – the echo and pulmonary function test, some of them are under "reports"; it's a different section where you go and find them. But then some of them are in the progress notes!"*
- Finding of information in general proved difficult, as there really wasn't a global find feature in VistA CPRS. Users would filter, browse, or develop a work-around to find and manage information – even hand written index cards. *Sample quote: "it would be helpful if we could do it by field…if you could say cardiology, it would be helpful…but it's only all notes, notes by author, and date range."*
- Labeling errors made finding notes difficult. Few checks existed to assure correct title selection, making it difficult to find information. *Sample quote: "I look at the titles, hoping that people put in the right title for their note."*
- Template design flaws including excessive boilerplate, and author misuse of copy-and-paste features made it difficult to wade through the text of notes. The ability to edit completed templates is often useful, but allows deviation from documentation "standards" and required data inputs. When a standard format is lost, it can be difficult for practitioners to read others' notes. Balancing authors' needs for efficient input and readers' needs for specific information is an ongoing challenge. *Sample quote: "if you don't have some required fields built-in, then some of that data is not captured either because of experience, time, priorities, that type of thing…"*

3.2.3. Barriers. At times, CPRS presented barriers making it difficult for users to work with system features.

In general, these problems appeared related to design of the user interface and seemed addressable without requiring changes in business rules, databases, workflow or organizational structure. These included:

- Custom filters were not as well used as the automatic filters. Available filtering techniques were often poorly understood by users. Filtering tools were obscurely placed in a deep menu tree, as well as clumsy and relatively difficult to use. *Sample quote: "Sometimes, I use this [date range] if I know the patient had a consult in 2002, so I pick this beginning date, and go to 2002. The thing is, you cannot even type it here, and it's hard to go back – it takes awhile!"*
- System navigation proved difficult for users, even those who had used the system for years. The exceptional complexity and size of CPRS records makes this no surprise. *Sample quote: "You go in to reports, and you go in to…maybe under health summary?"*
- Print-outs such as a patient sheet for making rounds could be improved. *Sample quote: "the sheet that the nurse uses for their "brain" is generated through CPRS, but it's very limited information."*
- References from external resources were used routinely by administrative staff. Practitioners desired more rapid access to these resources. *Sample quote: "If the government approves Micromedex as a reference, why can't it let me right-click on here and say here: definition…"*
- Poor usability was noted in some interaction sequences. *Sample quote:* "*…you see how many click, click, click (laughs)! Then, you have to go to save, save again, go back to add procedure if I have another procedure, change the date, the time I'll leave it there, run encoder again, click down where the procedure section is, put the procedure in, enter, say okay, then save again…and save again!"*

4. Discussion

The results demonstrate that overall the VA system had a number of beneficial features. In addition, users brought up several problems that in their experience they could not by-pass or satisfactorily resolve during their interaction with the system. Users' ability to develop work-around methods to address problems indicated both user resourcefulness and a degree of useful flexibility in the system. This section prioritizes the problems and looks into how these could be directly addressed by offering solutions, for example, in terms of re-designs of the interface.

4.1. Prioritizing needs

The problems that were identified during the content analysis are further analyzed and categorized into a priority scheme, "low", "medium", and "high" based on practical considerations. The lower the priority, the harder to fix a problem or implement a solution. Priority levels correspond to limitations, constraints and barriers mentioned in section 3. (Table 1).

Problem Area	Priority	Benefit vs. Cost
"Limitations"	Low	Low - requires advances in informatics
"Constraints"	Medium	Moderate - requires system redesign
"Barriers"	High	High - requires changing the interface, not architecture

Table 1. Problems, Priorities and Payoffs

4.1.1. Low priority. Limitations (as listed in section 3.2.1) may be questioned but unlikely to change.

In terms of cost or time, these problems are not readily addressable. Instead, users will continue to use and accept work-around methods for the foreseeable future. If solutions were to be addressed they would include:

- High availability of both server and client applications. Client applications that crash should fail gracefully, save the user's work and restart quickly without user intervention. When there is downtime, redundant read-only resources should automatically be available, and all paper forms needed for ordering should be readily printable.
- Deeper understanding of the entangled and competing needs of all groups of CPRS users by organizational leaders along with support for enhancing understanding between CPRS users in different roles.
- Deployment of mobile interconnected computing and clinical devices along with team-oriented software to support highly mobile workers such as floor nurses.

4.1.2. Medium priority. Constraints (as listed in section 3.2.2) are potentially addressable and may rectify these problems.

Changes to the information system or clinical workflow design could help alleviate these constraints – proposed solutions include:

- Providing prompts and sufficient time during patient encounters for updating high priority items like the Problem List.
- For data sorting, keeping track of additional metadata other than title, author and date – e.g., department/facility, specialty – and prompt for specific fields as needed at the time of entry. This could be expanded to VistA Imaging, to label or "tag" documents accordingly.
- Developing a global search function to allow users to quickly find information now available only by navigating and sorting hierarchical data structures such as "Notes", "Reports" and "Consults" etc.
- Improved support for standardization of templates including searchable headings, modular content, shared annotations and ability to associate records using hyperlinks rather than copy-and-paste.

4.1.3. High priority. Barriers (as listed in section 3.2.3) should be fixed, with relatively minor changes.

Such short terms fixes offer immediate performance benefit at modest cost. Proposed solutions include:

- Alerts need fine-tuning and an easier way for users to configure them. Some users would stated they would prefer getting notifications of new notes, for example..
- Custom filters need to be more intuitive. They shouldn't be buried in the menu but cleanly integrated in the interface. Further-more, advanced searching should be easily available, with date easily accessible.
- References and on-line resources are well-used by coders, but not in the clinical workplace. An easier method to access and use these in the context of work is desirable,

considering the value of reference information in healthcare practice.

- Usability still needs to be addressed in a number of areas: VistA Imaging needs a quick key to hide navigation elements. Improved methods to look up items in long lists are needed, possibly using combo/list-boxes and intelligent auto-complete capability. Finally, adoption of higher-resolution monitors with standard split screen support, to support processing of high information volume in patient records and usage of auxiliary programs, is needed.

4.2. Design solutions

A recurrent high priority theme in the interviews was the problem of finding relevant information in the presence of "information overload". For this pilot study, we proposed a design solution focused on enhancing two user interface aspects addressing information retrieval: <u>filtering</u> information and <u>finding</u> specific information. The identified requirements were implemented as a “wireframe” prototype, using animated screen shots based on the CPRS system and presented to users.

4.2.1. Existing Filter. As filters are currently implemented, a number of issues can be readily identified.

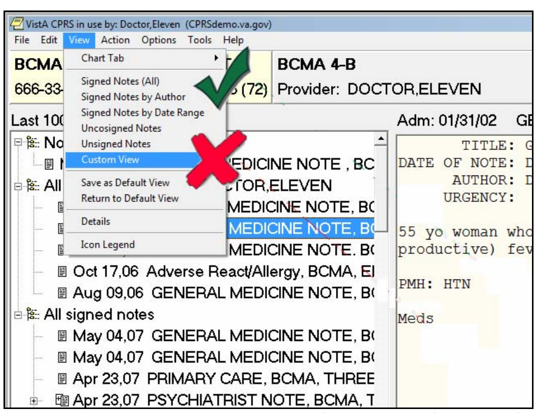

Figure 1. Existing Menu for View (Filters)

As shown in Figure 1, users favored and would select the auto filters (indicated by the green checkmark) – e.g., Signed Notes (All), Signed Notes by Author, Signed Notes by Date Range – but generally would not select “Custom View” (indicated by the red x-mark) or even considered it as an option.

Of those interviewed, only one user accessed a custom filter. Other users expressed a need for custom filtering abilities, but did not know how to use the custom filter..

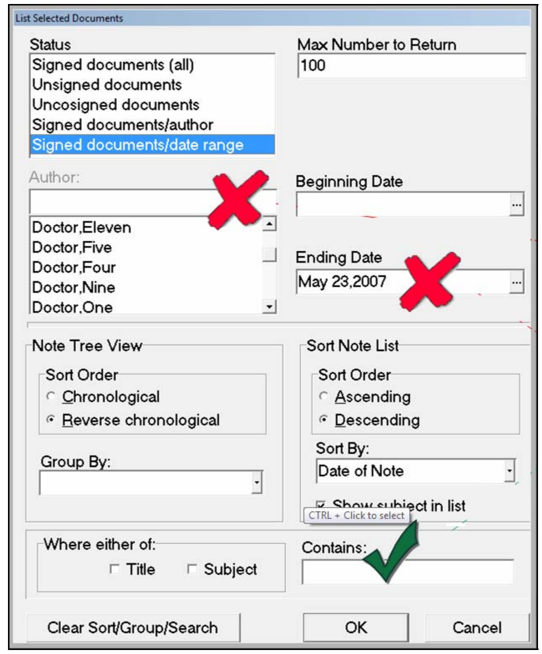

Figure 2. Existing Custom View Selections (Filters)

The current “Custom View” presents the user many choices, as shown in Figure 2. The use of the field “Contains” in Title or Subject proved useful (indicated by the green checkmark) – e.g., filter where title contains “medicine note.”

However, the use of “Author” was not particularly helpful (indicated by red x-mark on left) – instead, users stated it would be more helpful to filter by department, facility or specialty, as the doctor is not always known. Inconveniently, the use of the date control (indicated by red x-mark on right) opened an additional window (not shown here) which necessitated users to click for each month they wanted to go back. One user was observed to actually click 60 times to go back 5 years in the record.

4.2.2. Proposed Filter. Analysis of barriers using the existing filter suggested that a better filter could be developed.

One possible solution was to better integrate the hard-to-find filter into the GUI, making it more apparent to the user. Placing the view selections into the GUI avoided use of awkward dialog boxes for specifying customization criteria.

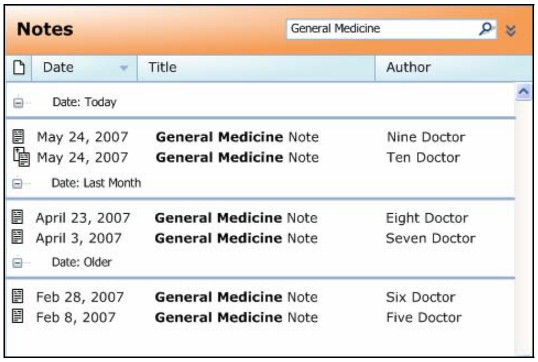

Figure 3. Proposed Filter

As shown in Figure 3, the filter is cleanly integrated into the GUI, highlighted in the orange header with a clear white textbox and a magnifying glass (typically recognized as a "search" button"). Typing into this textbox – e.g., "General Medicine" – would quickly filter results by specialty, and bold relevant text (a custom filter feature noted to be useful by some current users of the VistA CPRS system).

Furthermore, the columns themselves have now become ways to sort the record – here by Date, Title, and Author. However, the ability to add additional columns – e.g., department, specialty – would address issues raised by users.

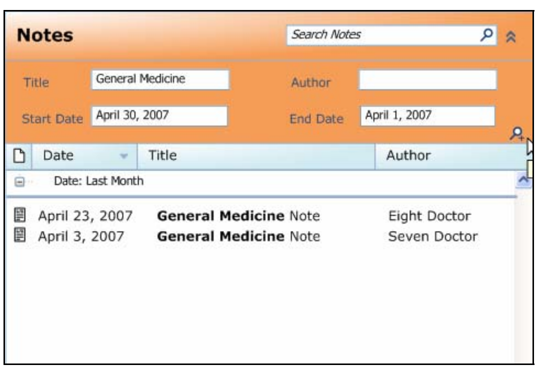

Figure 4. Proposed Filter Expanded

As shown in Figure 4, the filter can be easily expanded using arrows next to the magnifying glass – pointing them downward to access expanded choices for use, and upward to retract choices when not needed. The initial selections would be those used most often, along with start and end date filters that users simply fill out. A magnifying glass with a '+' next to it could allow users to add additional criteria fields.

4.3. Evaluation

In a small group discussion, three VA physicians familiar with the VistA CPRS provided feedback to findings and wireframes. They were presented a slide show with a summary of findings (benefits and problems), and presented images of wireframes (proposed solutions) for discussion.

The physicians appreciated the proposed filter integration into the GUI and the ability to easily expand filter criteria with additional terms. Furthermore, the wireframes elicited helpful feedback, which illuminated other issues in the system. One user identified a need to filter by *excluding* categories of notes – e.g., presenting surgical, but not nursing or pharmacy notes. Another suggestion was to support multiple ways to sort, e.g., group chronologically by several different practitioners or specialties.

The physicians also raised additional suggestions, such as the ability to quickly filter documents and to find specific sections within them such as the assessment and plan. Overall, comments affirmed the need to resolve other limitations and constraints in the system, such as the failure of templates to enforce standard document formatting and the desirability of keeping Problem Lists current and accurate.

5. Concluding remarks

Informed by a cognitive work analysis framework, this pilot study focused on the daily work experience of key users: practitioners, nurses and administrative staff. Our work-centered focus on documentation forced us to consider social factors in human interface design that are not well captured by focusing solely on individual perception and cognition. Documents written by one person may be read by many or no one at all. Users, pursuing their work goals require tools to navigate a large information space made unruly by the participation of many other motivated users. Our limited evaluation highlights the complex interactions of varying user work processes, goals and constraints found in health care.

Interviewing users about their work in the workplace permitted development of wireframes that were useful in eliciting additional productive user feedback. Improved filtering may aid information retrieval performance by helping resolve some of the complexity in CPD that derives from social and work environment factors.

An important lesson learned was that a work task-centered inquiry readily produces pertinent and useful insights about identifying and surmounting barriers to optimal use of the EHR and usefully supplements traditional user interface study methodology. Our interview data show that the social and work environment context in which information is produced and used is crucial to understanding how the EHR system performs. Accordingly, we intend to adopt a task-centered approach in the design of focus group interviews planned for the parent research project.

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