Clinicians' Assessments of Outpatient Electronic Medical Record Alert and Reminder Usability and Usefulness Requirements

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Abstract

Electronic medical record alerts and reminders are increasingly employed as a means of decreasing medical errors and increasing the quality and cost-effectiveness of care. However, clinicians indicate that alerts and reminders can be either help or hindrance. Discerning the elements that determine which they will be, and the requirements of a helpful alert or reminder, was the focus of this study.

We convened three focus groups, comprised of a total of 16 participants. During analysis, five themes emerged: Efficiency, Usefulness, Information Content, User Interface, and Workflow. In addition there were some New Ideas and Surprises.

Specific usability and usefulness requirements emerged from within the themes and these are described.

Introduction

Electronic medical record alerts and reminders are increasingly employed as a means of decreasing medical errors and increasing the quality and cost-effectiveness of care. They may serve as useful memory aids and may draw attention to a variety of situations in which safety, quality, or optimal utilization of scarce resources might otherwise be compromised. However, clinicians indicate that alerts and reminders can both help and hinder.

We hoped to achieve a more comprehensive understanding of the range and variability of relevant user attitudes. Previous work suggested that users have specific preferences for alert domain and presentation style and concern about increased numbers of alerts[1].

Methods

Focus Groups

We convened three focus groups, with 4 to 7 clinicians per group. The subjects were experienced Primary Care clinicians who all use EpicCare™, a comprehensive outpatient electronic medical record system, and were from Kaiser Permanente Northwest[2]. They all had computers in their exam rooms and included internal medicine, family medicine and pediatrics physicians, physician assistants and nurse practitioners. Clinicians were selected with the intent of balancing groups according to specialty, physicians and non-physicians, and gender. We obtained a list of potential subjects from Northwest Permanente employment records. An experienced scheduler recruited subjects from this list. Before each session all subjects signed an IRB approved informed consent. Following each session participants were given a nominal gift certificate.

Questions

We prepared 14 questions paying particular attention to clarity, order and potential for discussion and analysis. Ten individuals with knowledge of alerts and reminders reviewed the questions. The questions were revised and tested on two physicians similar to members of the target group. A sample of the script created from these questions is include below:

"Now, we have already heard expressed a number of different views and feelings about alerts and reminders. Let's focus for a few minutes on the circumstances where electronic alerts or reminders are *helpful* in your work. Can anyone think back to a recent example where an alert or reminder was helpful? What made it helpful?"

Screen shots of three general alert and reminder presentation types were shown and described, followed by: "Do you prefer one of these alert or reminder presentation types? If so, why?"

"All things considered, if you could tell system developers one thing to remember when designing electronic alerts and reminders, what would that be?"

Session Moderator and Observers

The principal investigator (MAK) served as the moderator for each session and asked all 14 scripted questions. Observers for each group were sequestered behind a one-way mirror. All sessions were tape-recorded. In addition the assistant moderator and all observers took

detailed field notes that were included in the data set used in the analysis.

Analysis of Recorded Data

The tapes for each session were transcribed and entered into computer software designed for qualitative research (Atlas.ti[R], SCOLARI, Sage Publications, Inc).

Codes were assigned to words or phrases in the transcripts according to concept categories discovered in the data, after the "open coding" technique described by Strauss and Corbin[3]. Later, related codes were combined into descriptive categories. The principal investigator coded the transcripts from all three groups, and the second investigator independently coded the first focus group. Codes independently developed were then compared, mapped to one another, and consolidated into related categories and finally themes.

Results

There were 5, 7 and 4 participants, respectively, in the three focus groups. They were 3 pediatrics, 5 internal medicine and 8 family practice specialists. Thirteen of the participants were physicians, 2 were physician assistants, and 1 was a nurse practitioner. The mean duration of time with Kaiser Permanente was 9.5 years, with a range of 1 to 24.5 years.

Overall, there was general endorsement of alerts and reminders. A number of specific usability and usefulness requirements and design elements emerged. Comments clustered into the five themes discussed below. Verbatim quotes from participants are presented in italics.

Efficiency

Users said that the most fundamental usability requirement is that the alerts and reminders must be efficient and not waste time. If they consume time, there must be the perception that this time was well spent. "*Yeah. It should add value and I think most clinicians consider it the number one value item, time.*"

A frequently suggested approach to increasing efficiency was "minimize": keystrokes, typing, mouse clicks, steps to accomplish a task, screens or window changes, switching between keyboard and mouse, and the amount and complexity of words to assimilate in order to make a decision. *"And if you have a fertile, diabetic woman who smokes, you're going to have to click through three screens---"* "*Yeah. Click, click, click.*"

Another suggestion was to facilitate completion of the computer recommendation by providing a convenient, accessible, and pre-populated alternative action on the same screen, thus avoiding the time for a new screen to be fetched and the user having to reorient to the new screen and task.

Usefulness

Users indicated that the perceived usefulness of an alert will largely determine its acceptance and they offered many criteria for a useful alert. First, it should be accurate and this has several dimensions. For one thing, the patient must be eligible for the alert. Whether the patient is selected by off-line processing of databases, or is selected via an on-line, real time inference process, false assignment should be minimized. "*With the aspirin thing…Somehow the coding meant they fell into the group…for the wrong reason. People would get upset because they were being told, "Oh, you forgot to put this guy on aspirin," and they didn't need to be on it anyway. So when there's some inaccuracy of whether the right patient is getting the right alert, it tends to be fairly aggravating."*

When new information is obtained, it should be very easy for the user to indicate that the patient is incorrectly assigned, and this should be followed by rapid correction. Furthermore, once the alert is satisfied through usual mechanisms eligibility must again be updated rapidly. Because some types of orders may routinely have a significant lag between ordering and availability of the result, it should be possible for the system to automatically "postpone, pending result" some types of reminders.

Permitting easy entry of exceptions or mitigating circumstances from the same window as the alert itself will also improve accuracy. Entry of this information should update the eligibility database, and the appropriate history section of the chart.

The system should distinguish between orders specified as "now" and those specified as "future" or "standing" and not consider them to be duplicates "*It prompts you either way. I mean, you specifically made it standing or future. It shouldn't ask you if you're sure.*" Similarly, there are instances where users expect the system to "be aware" of and utilize patient information that exists in the database, to more accurately target eligible patients. Age, gender, and known drug allergies should be used to further qualify patients eligible for alerts.

Beyond accuracy, there are other usefulness concerns. Users complained vociferously about annoying repetition and being told things they already knew. Many prevention reminders appear so frequently that clinicians feel the subject is internalized and that repetitive

alerts are both annoying and unnecessary. *"Well, I think anything that keeps recurring to me is [annoying]. If somebody who comes in ... is smoking - it doesn't seem to matter when you last talked to them. I think that comes up in any circumstance, does it not? That screen? I think every time a smoker comes in, you get that screen." "Yes." "Almost certain of that, because I carry a cross about smoking."* Particularly if they are doing well with performing these tasks, they ask "shouldn't I be allowed to turn this off, at my discretion?" Similar sentiments are expressed for other repetitive reminders, especially for commonly prescribed drugs with recommended alternatives or general safety reminders. On the other hand, some users appreciate these same reminders and might choose to continue them. A variation of this annoyance can be described as "I know what I am doing, thank you very much." *"Pharmacy reminders are sometimes a nuisance. When I decide to use an antibiotic, other than a first line, I've already thought it out. We prescribe antibiotics enough that we know what the first line is, but then you always get that alert."*

User Interface or Presentation Mode

The focus group participants had very interesting and important comments about the experience of interacting with the alerts themselves. First, they validated the importance of adherence to basic principles of user interface design including minimizing scrolling, maximizing flexibility of action, and ensuring that the size and placement of buttons and other controls are designed to achieve speed and minimize error.

Second, users said they would like more information available with less effort so they can evaluate and act on alerts and reminders more easily. They would like to know, for example, by glancing at a passive reminder not only its broad category (e.g. Health Maintenance) but also something more specific (e.g. perhaps, "Tobacco" or "Pap"). They would also like more information, at a glance, about their In-basket activity. They wanted to be able to tell when they had new alerts in each In-basket category. Generally, users want to make at least an initial triage decision without having to click. *"Like the Health Maintenance one..." "Yeah, you see it, but you have to do something to even find out what it means."*

The third group of issues identified is the optimal intrusiveness for a given alert. A related question is whether the alert should be modal (requiring immediate attention before the user is able to move on) or non-modal (and thus deferrable without specific action). Users varied on whether they were likely to respond to completely passive alerts, especially of a less urgent nature. Some acknowledged they were unlikely to respond, or perhaps even be aware of alerts, unless they were intrusive. However, even some of these users acknowledged that "pop-up" alerts can be very annoying, especially when they are "not right" for some reason. There was consensus that intrusive, modal alerts must be important and used very selectively. *"And don't make things red unless you need to attend to them right now." "Mean it".* However, users suggested that when timely attention to an alert is crucial, an intrusive alert would increase awareness, and possibly compliance, compared to a passive alert.

Users discussed the dilemma and apparent contradiction between the desire to avoid unnecessary or untimely interruption, and the requirement that alerts be sufficiently conspicuous that they are not ignored or indefinitely deferred. One proposed solution was a window available by a single click (such as via a tab metaphor) on which the alerts and reminders for the given patient accumulate before, during and after the patient visit as new information triggers related rules. If the tab was populated with new information, it would be conspicuously indicated, such as by turning the tab bright red. Most users indicated the most important (but not necessarily only) place in the application to provide access to this tab is where orders are performed. Another similar suggestion was instead to pop up this "accumulator", at least on the orders screen, but to do so in a non-modal fashion. This "floating" window could be resized, repositioned, and even dismissed (back to a tab) but would ordinarily be a visible reminder of the recommended activities for the patient. These could be addressed, however, at the user's convenience and discretion.

Finally, users would like to have the ability to customize and control when, how, and where alerts present to them, acknowledging that there are different user preferences, needs and requirements. Rather than creating a "one size fits all" approach that will somehow try to accommodate everyone, one could create a system that automatically adjusts to the user, or give the user the ability to set and maintain preferences. While there may be appeal to an automatically adjusting system, creating such a system would not be trivial and in any case would likely include allowing users to set certain

preferences. It is presumed that there would be constraints within which these preferences could be set. For example, users might have a different level of control over an organization's "business rules" than it would for "safety rules." The latter, at least beyond a certain threshold of evidence, might be mandatory.

Information Content

Alerts and reminders contain information and it is the timeliness, richness and accessibility of that information that determines their value. Sometimes the clinician specifically seeks more information. On other occasions it presents unsolicited as a by-product of an event or action. Sometimes the alert assists in the "discovery" of an unknown, or overlooked aspect of a patient's history, and often it assists in information gathering, leading to a more complete or more well informed decision. *"I saw somebody for something innocuous and was not aware they had diabetes. I reviewed their labs, because of the A1c alert. They came in for an ankle, so it really changed the whole dynamic of the encounter."* Users appreciate the ability to seamlessly link to other knowledge resources across the Intranet and Internet, from within the application. They see additional opportunities for such links.

Workflow

A large number of the issues that emerged comprise a broad workflow or "timing" category. Users said that for an alert or reminder to be ideal it must appear either at the appropriate time for consideration and action, or in a manner in which the user can determine if and when to evaluate and respond to it. They said that pop-up alerts particularly were annoying or unhelpful if they popped up "too early" in the encounter, or on the wrong screen. This concern is partly because of the disruption of the thought process that this causes, and partly it is simply that the clinician may need more data or may need the opportunity to speak with the patient first. The alerts were most likely to be helpful if they presented when the users were entering orders or were otherwise at the point of making a decision about the issue in question or closely related issues. For example, alternative medication reminders were frequently appreciated. *"The thing that got you there was you were ordering an antidepressant, and you typed in some drug and hit return, and it popped you to that box. You're still going to be able to order your antidepressant there and it hasn't slowed you down at all".*

Users also said that computers in the exam room improve the likelihood that alerts will appear at a helpful time. They reduce rework and the embarrassment of having to revisit decisions with the patient based on information they receive while entering orders in their office, and increase the likelihood they will follow the recommendations of the reminder. On the other hand, alerts that are triggered by charting tasks rather than by ordering tasks may not be seen in the exam room workflow, as many clinicians complete their charting outside of the exam room, often after the patient has left.

Sometimes given the presenting or emerging problem(s) of the visit a particular alert or type of alerts may be seen as inappropriate. *"If I'm seeing somebody who's having an acute stress reaction or their life is falling apart, that's not the time I need to be talking to them about quitting smoking."* It would be nice if the system were "smart enough" to recognize some of these situations and suppress certain reminders under such circumstances.

An observation that users made is that sometimes the alerts could be presented to someone else in the clinical workflow. This reflects a desire to logically stage and distribute the work, and thus utilize the most cost-effective strategy for delivering care. Reminding nursing staff in some instances, for example, might be more effective for the patient and certainly less burdensome for the clinician.

New Ideas

A number of innovative ideas emerged in the focus groups. One of these was affording users more control over the alerts including the option of turning certain alerts off for a period of time. Allowing users to set preferences about how and when they preferred alerts to present was also proposed. Also suggested was an intermittent alert schedule in which specified reminders would be presented only periodically, such as every other time they were triggered. This might apply to informational reminders and not to high priority safety or business alerts. Individualization of alerts by clinician was suggested to ensure that the number and quality of alerts received by any individual was acceptable. This could be achieved by filtering alerts according to criteria such as the specialty, degree, and past performance of the clinician. An especially innovative idea was that the alerting system could actually track clinician performance on a variety of quality and utilization measures, modifying its alerting behavior based on this information.

Several new types of alerts and reminders were offered including blood pressure and laboratory value trend alerts and an automatic cardiovascular risk calculator alert. Another suggestion was the notion that the computer system could set up ("pend") or possibly even place an order without specific clinician involvement if it determined by inference that a patient was due for a given test or immunization. It was even offered that the computer might do this outside of an office visit, perhaps mailing the patient a letter or placing a phone call to ask the patient to come in for the procedure. Finally, several people said they would like the capability to create and assign patients to custom alerts and reminders, advising them to call patients back at certain intervals or perform certain tests on them when they returned.

Surprises

A few results were unexpected in direction or degree. It was not anticipated that users would feel so emotional about alerts and reminders. They noted feeling at times criticized, embarrassed, guilty, frustrated, annoyed and angry. These responses underscore the sincerity and seriousness with which clinicians approach their work.

Although it probably should not have been, it was somewhat surprising that users did not always seem to understand how to use and manage the alerts effectively. This resulted in some unnecessary repetition of alerts and contributed to user frustration.

It was to some extent surprising to hear from a few clinicians annoyance with the Electronic Medical Record as a vehicle for delivering the quality and utilization messages that are part of the culture of Kaiser Permanente. It was disappointing to hear inferences that an unnamed and faceless "them" were forcing their values onto the clinician recipients of the alerts and reminders.

The decreased emphasis on the importance of numbers of alerts, compared to other factors, was unanticipated. Users said it is more significant that the alerts are important and timely.

Finally although it was understood that context, timing and workflow are significant elements in determining the usefulness and usability of alerts and reminders, it was not previously appreciated that these elements are so vital that they trump everything else.

Discussion

User centered design is an important practice in modern software development. Our focus group participants told us their requirements for usable and useful alerts and reminders. They said: 1. Minimize keystrokes, mouse clicks, scrolling, window changes and complexity 2. Facilitate alert completion with pre-populated alternatives 3. Facilitate exceptions entry 4. Assign patient eligibility correctly and make updates easy and rapid 5. Utilize stored patient data to more precisely target patients 6. Selectively target users based on department, degree and other user characteristics 7. Provide enough information to allow a triage decision at a glance 8. Facilitate links to other information resources 9. Give users some control of reminders so that they can avoid unnecessary ones 10. Modal alerts should be important and used very selectively 11. Present alerts and reminders within the workflow, at the point of decision, or at user discretion.

Conclusion

The objective of this qualitative study was to acquire a better understanding of the usability and usefulness requirements of outpatient Electronic Medical Record alerts and reminders. From a substantial volume of responses to specific questions, emerged five major themes: Efficiency, Usefulness, Information Content, User Interface and Workflow. In addition, there were some New Ideas and Surprises. Finally we have described the specific usability and usefulness requirements that emerged from within the themes. Some of these requirements will be more difficult to achieve and others will require more analysis before beginning implementation. System developers that consider and respond to these requirements should be more successful in designing alerting and reminding systems that users find both usable and useful.

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References

1. Krall MA and Sittig DF. Subjective assessment of usefulness and appropriate presentation mode of alerts and reminders in the outpatient setting. AMIA Proceedings 2001, 334-338.

2. Chin H, Brannon M, Dworkin L, Krall M, McClure P, Robertson N, Wallace P, Weiss D. Kaiser Permanente- Northwest. In: Overhage JM, editor. Proceedings of the Fourth Annual Nicholas E. Davies CPR Recognition Award of Excellence Symposium. CPRI, Bethesda, MD. 1998,55-100.

3. Strauss A and Corbin J. Basics of Qualitative Research. Sage Publications 1998.